



Impressions
of the
USSR

HAROLD
GRIFFIN

2nd EDITION

Soviet Frontiers of Tomorrow



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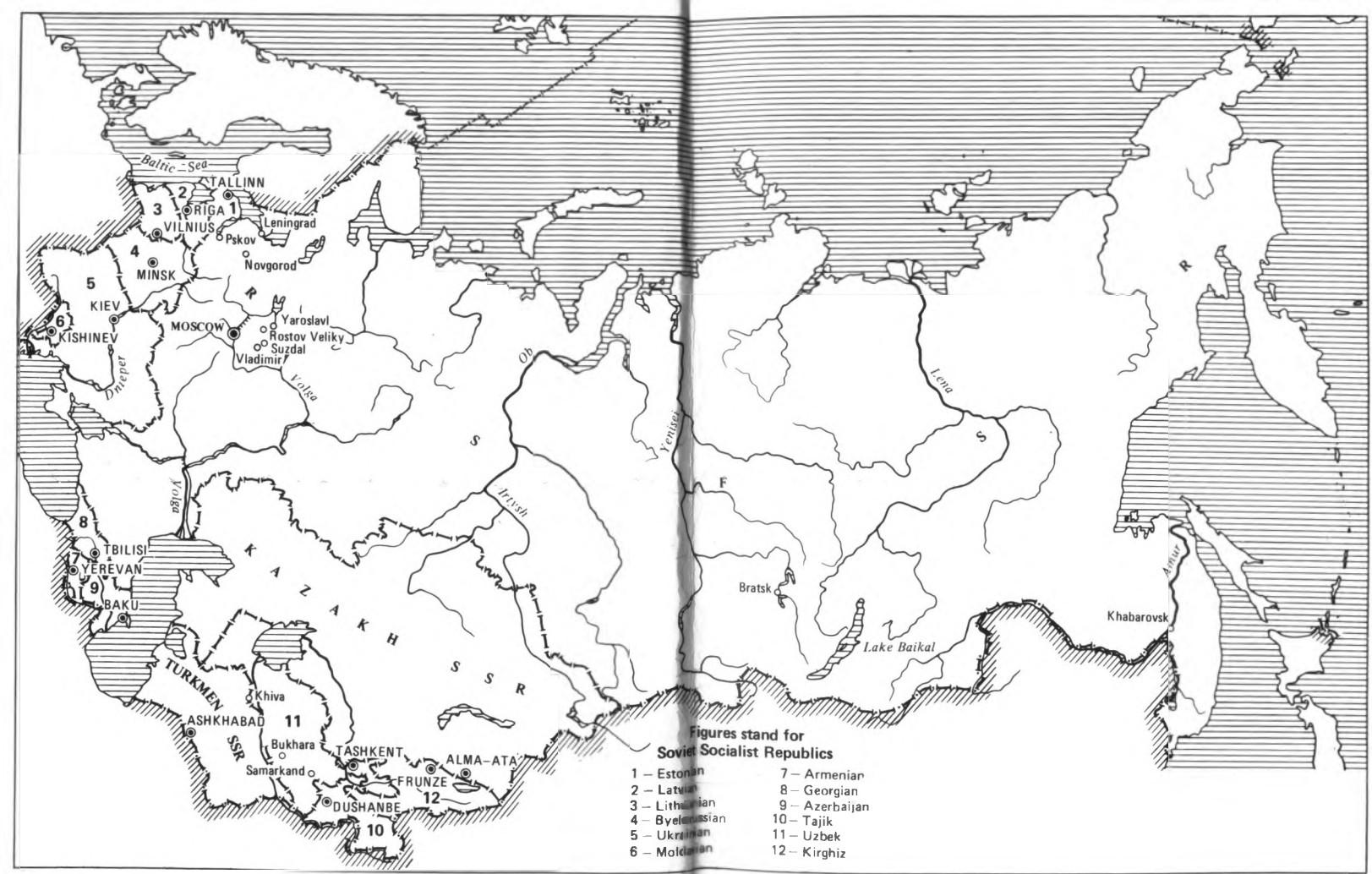
Where to obtain knowledge of the Union of Soviet Socialist Republics—a country that has made a spectacular passage from a tortuous past to a radiant present?

Books of the Impressions of the USSR series put out by Progress Publishers offer many an interesting account of the fast advancing Soviet society. Authors published in this series are eyewitnesses in the sense that they have all visited the Soviet Union and have seen life there at first hand. Theirs is an unbiased story about the men and women who so rapidly transformed Russia of the tsars into one of the world's most advanced countries. Books of this series deal with a variety of topics concerning the swiftly growing Soviet society that is building communism.



To write this story of Siberia's amazing development, achievements in desert reclamation projects and space exploration, the author travelled extensively about the Soviet Union, talking to workers and scientists, engineers and farmers, writers and cosmonauts, and it is through their eyes that he describes the transformation of the country. Specifically, it is, he says, the first time in history that a frontier has been opened and developed according to a plan, equipping the enthusiasm of youth with modern technology and advancing instead of decimating its native peoples.

Drawing on his own earlier experience in the Canadian north, the author interweaves past and present, from exploration to the space age, to give readers abroad a view of what he regards as a great socialist success, profound in its implications for peace and progress.



HAROLD GRIFFIN

*Soviet
Frontiers
of
Tomorrow*



Progress Publishers
Moscow

Also by Harold Griffin:

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Гарольд Гриффин
СОВЕТСКИЕ РУБЕЖИ БУДУЩЕГО
На английском языке

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Second printing 1984

Printed in the Union of Soviet Socialist Republics

Г 0802010203—159 без объявл.
014(01)—84

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CHAPTER I

From the Yukon to Siberia

For a few minutes the dense cloud thinned and parted. Craning my neck, I could see far beneath the plane's lifting wing a sombre expanse of forest broken here and there by upthrust grey rock and the dark glint of water. We were crossing the Urals, the worn mountain range that runs like a spine down the Euro-asian land mass, more than 2,000 kilometres from the Arctic coast of the USSR to the desert on the Kazakhstan border, dividing Europe and Asia. Until the clouds closed in again, I savored my first glimpse of Siberia, the land of which I had heard so much and knew so little and had waited so long to see.

It is close to half a century since a Métis trapper whom I remember only as Tom parted the mist of ignorance to arouse my interest in Siberia, which until then had been for me little more than a broad expanse on the world map threaded by long rivers and sparsely dotted with unfamiliar names.

Travelling over the ice of Tagish Lake from Carcross in the Yukon Territory to the tiny Indian settlement at Tagish, we had taken shelter from a driving snowstorm in a derelict log cabin.

Built on a rocky point of the lake during the gold rush days three decades earlier and long since abandoned, the cabin was scant shelter. The door and the window were gone and the cold seeped through the logs where the moss chinking had fallen out. But the sheet iron stove was still intact, sending out a fierce wave of heat as Tom filled it again and again with wood heaped in one corner of the dirt floor. Outside, along the cabin wall where we had left the sled, the dogs lay patiently in their leads, seemingly oblivious to the snow swirling about them. Beyond the cabin the lake ice merged with the yellowish mist and the only sound was the soft hissing of the snow.

Seated on a hewn wooden bench, the sole remaining piece of

furniture in the cabin, his mug of tea clasped in his gloved hand, Tom was happy. Until the storm blew over he had a new audience, some one who had never heard his stories before.

"You didn't know I was in Siberia, did you?" he said presently.

"When was that?" I asked.

"Right after the war, in 1919," he replied. "I was with the Siberian Expeditionary Force."

It appeared that he had been selected for the force because he could handle a dog team and was wise in the ways of the wilderness. Whether he went as a volunteer or as a conscript, he did not tell me, but he was soon disillusioned. With his knowledge of French, he found his close friends among the French Canadian conscripts, six of whom refused to sail with the battalion when they reached Victoria, B. C., and were taken aboard under armed guard. The quarters on the British freighter which took them to Vladivostok were cramped and dirty and the weather in the North Pacific was so rough that one man was killed in falling down a coal chute.

"It took us about three weeks to get there and by that time most of us wished we had never left," he said. "Then we began to wonder why we had ever been sent."

As he related his experiences of dreary garrison duty in Vladivostok, his own feeling that Canadian troops had no business there, in the few months before dissent in government and widespread opposition at home forced their withdrawal, I found my interest growing. To him, as to me at that time, Siberia was the entire territory stretching from the Pacific coast to the Urals, not as it now is differentiated, the Maritime regions of the Soviet Far East and Siberia proper, with a land area slightly larger than that of Canada. In that first winter in the Yukon I was still in my teens, acquiring my first experience of my own country's vast northern territories. Suddenly I was being made aware of another huge territory across the Arctic Ocean, across the Bering Strait, the counterpart in so many respects of Canada itself. I was also learning a chapter of Canada's past about which all the histories I had read said little.

Years later I was to hear from Jack Treliving, a Canadian Pacific coast fisherman, about another aspect of Canada's inter-

vention in Siberia, undertaken at Britain's urging, prompted by a desire to gain a large share of postwar trade with Siberia under a whiteguard régime and dictated by the hatred of the new Soviet government it shared with other Allied governments.

As Treliving told me at his modest little home on the Fraser River, some 40 kilometres east of Vancouver, B. C., he was at training camp at Petawawa, Ontario, in 1918 when an appeal was made at a special muster for volunteers to join the Siberian Expeditionary Force.

"That night an older man named Gibson I chummed around with came into the tent when he saw I was alone and told me he was thinking of volunteering. He wanted me to go with him," Treliving recalled. "Later we went down to the canteen to talk it over. 'Look,' he said, 'I know you hate the army.' 'I sure do,' I said. 'I want to get out. I can't see anything in all this damn fighting.'

"'Well,' he told me, 'you come with me and when we get over there we'll just watch our chance and desert to the other side. I tell you, that country's going to go ahead. They're fighting for something worthwhile.'

"He convinced me and I volunteered with him."

When 'flu hit the Petawawa base camp, the troops destined for Siberia were sent to a camp at New Westminster, B. C. After that the weeks dragged by while they awaited the order to embark. On several occasions they were told to get ready, but always the order was cancelled. Rumors went around the camp that the longshoremen in Vancouver were deliberately slowing down the work of fitting the troopships with horse stalls because they sympathized with the Bolsheviks. The long awaited order finally came in January 1919.

"We left at 1:30 in the morning," said Treliving. "We had to ride the horses at a walkover to Vancouver. They had us down on the railway track and we could hardly hand on to the horses—you know how their feet click the rails. When we got there we stood around waiting to put the horses on board. The sergeant came along and we asked him, 'When are you going to load?' 'Don't know,' he replied. 'The boat isn't ready.' We knew the longshoremen were still holding things up."

And indeed, the Longshoremen's Union, which had passed a

resolution of support for the Bolsheviks, was only part of a growing protest movement against intervention which the Union government of Prime Minister Sir Robert Borden strove vainly to suppress by its order in council of September 1918 banning 14 organizations. In face of the hysteria and violence whipped up by the press, police raids and arrests and the seizure of literature, the labor organizations redoubled their demand for an end to intervention. Defying censorship, suppressed labor papers reappeared under new names. The *Western Clarion* became the *Red Flag*, proclaiming in its issue of February 15, 1919, "From every part of Canada the cry goes up: 'Bring the boys back home.' We join in that cry with all our strength: 'Bring them back home from Siberia!'"

The demand was raised to a peak at the Western Labor Conference held in Calgary, Alberta, March 13-15, 1919, and attended by trade union delegates from the four western provinces. Expressing the virtually unanimous sentiment of its 239 delegates, the conference endorsed the call for a general strike on June 1 if Canadian troops were not withdrawn sooner, both those on the Murmansk front and those in Siberia.

The capitulation of Germany deprived the Borden government of its sole pretext for sending Canadian troops to the Soviet Union. Division in the Union cabinet, in which the Conservatives held 13 portfolios and the Liberals 10, was expressed most forcefully by T. A. Crerar, then Minister of Agriculture, who informed Borden flatly: "I cannot agree that the retention of our forces in Siberia and the securing of further forces there can be justified on the grounds of necessity of reestablishing order in Siberia. The matter of how Russia will settle her internal affairs is her concern—not ours." In April the government began recalling its troops.

They did not have to bring Treliving back from Siberia. He never got there. When the ship sailed he was in sick bay, down with the 'flu. It made little difference. After five days at sea the ship returned to port in Vancouver. The horses were all seasick, some of them in such poor condition that they would have had to be destroyed had they ever reached Vladivostok.

It was a dismal venture that gave no lustre to Canada's burgeoning role in international affairs.

When I went north again, early in 1943, travelling in the Northwest Territories, the Yukon and Alaska, to gather material for my book, *Alaska and the Canadian Northwest: Our New Frontier*, Canada and the United States were at war with Japan and the Soviet Union was our ally in the war against Nazi Germany. At Stalingrad, after a defense that commanded admiration wherever men and women were fighting fascism, the Soviet counter-offensive had encircled the German Sixth Army and forced the surrender of Field Marshal Friedrich Paulus and the remnant of what originally had been a 300,000-strong army. It was the turning point of the war and Alaskans had a personal interest in it surpassing its effect on the course of the war.

As I soon learned when I reached Fairbanks, it was an open secret the Soviet fliers were quartered in the city, long enough only to familiarize themselves with the U.S.-built planes they were ferrying across Alaska and Siberia to the war fronts of Europe. I saw them occasionally on the streets, in the cafés and in the stores, where it still was possible to buy things unobtainable in mainland U.S. cities. Most of them were very young, unobtrusive and disciplined. When they flew it was with a skill and daring acquired in combat experience, and Alaskans, the most air-minded of all Americans, would shake their heads in disbelief. Yet even at that time, when Soviet fliers were dying in the skies above the Stalingrad front and the future of the world hung in the balance, there were some, the carriers of the cold war virus, who were direly predicting that some day the planes would return to bomb Alaskan cities.

To Alaskans at the beginning of 1943, however, the war with Japan was the overshadowing concern. A Japanese force had invaded the Aleutian Islands and was dug in on Attu and Kiska. Cities along the Alaskan coast were under imminent threat of further Japanese attacks. Unlike Americans in the continental United States, separated by the vast expanse of Canada, Alaskans have always been better informed about the Soviet Union as their close neighbor across the Bering Strait. When U.S. newspapers engaged in scaremongering in the prewar years, as they did, for instance, in widely published reports in 1939 asserting that the Soviets were fortifying Big Diomede Island in

the Bering Strait, they were in a better position to know that the supposed fortifications were in fact a weather station. Their fear was of militarist Japan, whose ports were as close to western Alaska as the ports of the U. S. Pacific coast.

Throughout the prewar years, conscious of the vulnerability of their shipping lanes, Alaskans had campaigned for the construction of a highway through Canada to link their territory with the continental United States. Its foremost advocate was Donald MacDonald, the Alaskan location engineer who built the Steese Highway from Fairbanks to Circle on the Yukon River. Seeking a feasible route for an Alaska Highway, he made long trips into the wilderness. Delving into history for supporting arguments, he brought to light an old proposal for the construction of an international railroad linking Canada and Alaska with Siberia, as discussed by E. H. Harriman, the American railroad promoter, with the tsarist government at the turn of the century. Instead of an international railroad, why not an international highway, an extension of his dream? He promptly wrote to the Soviet government to ascertain what highways in the Soviet Far East and Siberia might link up with an Alaska Highway.

Where MacDonald's persistence gained him a hearing but scant support at Washington, the Japanese invasion of China in 1937 gave new point to the highway proposal. In 1938 the Roosevelt administration at Washington and the King government at Ottawa each appointed a commission to investigate three proposed highway routes. The U.S. commission favored a westerly route from Hazelton, B. C., to Whitehorse and Dawson City in the Yukon and then to Fairbanks. The Canadian commission wanted a more easterly route by way of Prince George, B. C., and Dawson City to Fairbanks.

It took the Japanese attack on Pearl Harbor in December 1941 to end the years of controversy and frustration. Suddenly the danger to Alaska was apparent. Within three months the U.S. and Canada had reached agreement on the construction of the highway, but over a third route that neither commission had recommended, and heavy road-building equipment was on its way to Dawson Creek, B. C., over the Northern Alberta Railway and to Carcross and Whitehorse over the White Pass and

Yukon Railway, the only access routes to the wilderness through which more than 2,500 kilometres of highway had to be built across muskeg and permafrost and gumbo that became thick greasy mud in the spring.

The U.S. troops, black and white, who built the highway for the most part had no experience of road-building and little access to the experience of others.

"We knew the Russians had built roads through similar country," Col. Albert E. Lane, the U.S. commanding officer at Dawson Creek, told me, "but we had no accounts of their experience. All we had was an article on road-building in Alaska which was written in 1917 and published in Hager and Bonney's *Highway Engineer's Handbook*. This advocated the cleaning out of all muskeg areas. We learned from our experience, however, that while this could be done effectively where the muskeg was shallow, it was better to build on top of the muskeg where it was deep. We laid corduroy on top of the muskeg, continuing to fill as the muskeg thawed and the road sank into the slime. In some particularly bad spots we had to use as many as eight layers of corduroy and dirt."

As I said in a series of articles I wrote for *New Masses* in 1944, when the Truman committee was questioning whether in fact the Alaska Highway should have been built at all, its shortcomings were the consequence of neglect and unpreparedness "which obliged the U. S. Army Engineers, without any extensive experience of construction work under sub-Arctic conditions, to undertake projects which should have been started long before and to complete them in record time".

The U. S. could have had access to a wealth of Soviet experience in northern development and construction. But, as I pointed out, "those were years when very few Russians visited Alaska, when a wall of suspicion denied the geographic proximity of Alaska and Siberia. Alaskans, however curious they might be about the accomplishments of their neighbors across the Bering Strait, knew only that Siberia was being transformed while their own great territory languished, written off in the minds of most Americans as a wilderness unfit for settlement... Alaska and Siberia, the new frontiers of the twentieth century with so many problems in common, so much to be achieved

only through cooperation, were neighbors who seldom went beyond distant speaking terms".

Yet I did find Alaskans who were not only well-informed about Siberia, but had lived and worked there. One of them was Bert Carlson, a Swedish-born mining engineer, who acquired his experience as an expert in thawing frozen ground in the gold-dredging operations at Dawson City and Ruby, on the lower Yukon River in Alaska. In 1922 he went to work as a consulting engineer in the Aldan goldfields in the Yakut Autonomous Soviet Socialist Republic.

"You could put me down in some parts of Siberia and I would think I was still in Alaska," he said when I talked to him at his Fairbanks home. "The Russians have established industries and built cities in the north. We can do the same." His Russian-born wife whom he met and married in Siberia nodded. "When I came to Alaska I found it very different here and yet not so different," she explained. "The country, yes, it was very much the same, but it seemed that so little was being done. When we left Siberia the whole country was changing. People came to a new district and stayed awhile and then they moved to a new district. Roads were being built everywhere."

From Fairbanks, where modern buildings were gradually displacing the log cabins of an earlier era, I flew out to Nome, then still recovering from the fire in 1934 which destroyed much of the town. War had brought fewer changes to Nome, founded in 1899 out of the gold rush to its beaches, on which men and women still sluiced for fine flour gold in the summer. But the beaches themselves with their broad sweep of pounding surf were littered with discarded equipment, battered oil drums, broken pipes, even parts of railroad cars, as though the townspeople were using them as a dump. The federal building, a modern school and a few other buildings pointed to the future, but everywhere, in the false-fronted stores, the log and frame houses spared by the fire, the imprint of the past was strong.

The day I left Nome, the grey sky of preceding days had cleared overnight to a pale translucent blue. Flying northwest across the discoloring snow of the tundra to Tin City, the site of Alaska's only placer tin-mining operation, and Wales at the tip of the Seward Peninsula, the outline of the Chukotka Penin-

sula emerged from the haze at the edge of the horizon. Beyond lay Siberia. But it would be nearly 40 years before I saw it.

Now, breaking out of the cloud that had denied any except that one brief glimpse of the Urals throughout the three-hour flight from Moscow, suddenly the city of Tyumen was spread out below.

I nudged Lyalya Chalyan, who had dozed off. A young editorial assistant, she had volunteered to accompany me on what was to be her own first visit to Siberia, leaving her husband to cope with their six-year-old son's opening day at school. Slight and dark, she was of unmistakably Armenian origin, although she had never been to Armenia. She always looked a little sad and try as I might I could never coax more than a faint smile from her. This time was no exception. "What is it?" she asked. "We're coming in," I said. She looked sad. "I hope there is some one there to meet us." And some one was—Valery Bylino, deputy chairman of the Tyumen Committee for Publishing, a tall, thin young man, and his driver. They had waited patiently for two hours, not knowing that was how long we ourselves had waited at Moscow for our flight before we were transferred to another.

That night, after we had unpacked our bags and eaten supper at the Oil Workers Hotel, we went for a walk around the streets. It was raining, a steady light drizzle, and no city is at its best in the rain. The water dripped from the birch and lime trees lining the streets and washed the mud from the boulevard strip between the sidewalk and the curb. It collected in pools on the roadway and splashed back on to the sidewalk with every passing vehicle—and there was a constant stream of trucks and cars far into the night. Only a block from the hotel we had to detour around a large water-filled crater in the roadway. Was this Tyumen, the gateway to Siberia? I returned from the walk with a feeling of disappointment. I had read so much about the spacious new cities of Siberia and these narrow streets and old buildings were hardly what I had expected.

A clearing sky and pale sunshine in the morning changed the perspective. Not only had I seen the city at its worst, I had seen the worst part of the city. The hotel was in the old part of town, set among log houses with intricate gingerbread facings,

some of them leaning a little under the weight of their years, and other aging but more recent buildings erected in the pre-war and early postwar years.

This old town was to be rebuilt, although not everything was to be demolished. Valery told me as he took me around the city. The best of the old two-storey log houses were to be preserved, perhaps on their present sites, perhaps in a special area to be created just outside the city. The plan for the rebuilt city unfolded under his pointing finger. "That's where the new administration building will be . . . here there will be a new medical complex . . . this is the site for the new railway station . . . the new museum will be here . . . this whole street is to be rebuilt, three times as wide as it is now."

In the outlying areas the new city already has taken shape, a bright shell around the old core. In fact, it is possible to trace the development of the city by the changes in its architecture, from its founding in 1586 as a trading centre for Moscow merchants on a height overlooking the Tura River and its subsequent spread along and back from the river, its slow growth after the revolution and its rapid expansion during the Second World War, when some 100 industrial enterprises were moved to Tyumen in face of the advancing German armies. After the war about one fifth of these enterprises remained to make the city, now grown to about 360,000 people, one of Western Siberia's most important industrial centres.

In the new districts, wide boulevarded streets, broad highways and overpasses are part of the new Siberian urban pattern. The apartment blocks lining them are varied, well-spaced and staggered in their setbacks. The massive blocks of earlier periods, stern solid walls lining each side of the street, have given way to styles that allow architects and builders to expand their concepts without sacrificing the advantages of prefabricated materials. Space is not wasted; it is used more imaginatively.

On our way back to the hotel, Valery indicated the present administration building, an imposing white structure filling one side of Central Square, fronted by gardens alight with a mass of purple phlox against a background of grass and trees. "This used to be the site of a timber market," he said. "And over there"—he pointed across the square to where a statue of Lenin

stood—"is where an army barracks used to be. This street is the Ulitsa Respubliki—Street of the Republic—and back in the last century it was almost impassable in the spring. Horses and wagons used to bog down in the greasy mud and people had to pick their way along slippery wooden sidewalks."

I told him the apocryphal story about Winnipeg in its early days a century ago, about the newcomer plodding his way through the mud of Main Street who saw a fur hat lying on the road. As he picked it up, a voice from the mud remonstrated with him. "Please put that back," the voice said. "I'm standing on my wagon down here and I feel cold without it." Valery laughed uproariously.

That led us into a discussion of Tyumen's early history and inevitably to Yermak.

With his force of some 800 Cossacks, Yermak set out from the Stroganov merchant family estate in 1581 and a year later defeated Khan Kuchum and seized his capital, Sibir, on the Irtysh River not far from present-day Tobolsk, which was founded in 1587, one year after Tyumen. Yermak was subsequently drowned while escaping a night attack on his camp, but the West-Siberian Tatars, Turkic-speaking descendants of Genghis Khan's warriors, were unable to stem the Russian advance. The way to the east was open. The prize, as in Canada, was furs.

The speed of the Russian advance from the Urals to the Pacific was remarkable. From the founding of Tyumen, the first *ostrog*—walled town—in 1586, the Russians pushed to Tomsk in 1604, Krasnoyarsk in the Yenisei basin in 1628, Ilimsk in 1630 and Yakutsk in 1632. In 1646 the *ostrog* of Okhotsk was founded on the Pacific coast and in 1648 the Cossack explorer Semen Dezhnev reputedly sailed along the Arctic coast around the eastern tip of Siberia—the cape now named after him. In the space of 60 years the Russians had pushed clear across a continent.

As the French and English fur traders did in Canada, the Russians used the rivers as highways, but in Canada the advance was far slower. From the founding of Quebec by Samuel de Champlain in 1608, the French, after the first surge westward by Etienne Brûlé and Jean Nicolet, had not penetrated past Lake

Michigan by 1648 and the English were still exploring Hudson Bay, searching for the Northwest Passage. Not until 1793, when Alexander Mackenzie reached the Pacific coast at Bella Coola, nearly a century and a half later, was the crossing of the North American continent completed. And four years earlier, in 1789, Mackenzie had descended the river, which now bears his name, to its mouth, carrying with him maps of northern Canada made by Peter Pond, his fellow explorer and fur-trader, which he was to present to Catherine the Great after he reached Russia by way of Unalaska and Kamchatka. Instead of the North Pacific, where Pond's maps showed the Mackenzie discharging its waters, he found himself on the Arctic shores of the Beaufort Sea. By that time the Russians had been in Alaska for half a century.

Even before the need for new sources led the Russians into Siberia, furs had become an important part of the economy of Moscow, Novgorod and Kiev. Access to the new sources greatly increased the revenues to the state, but only as long as the flow of furs to the trading posts was maintained. Within a few years the intensity of the hunt so reduced the numbers of fur-bearing animals in an area that the *promysloviki*—seekers after furs—were constantly impelled eastward, from one river valley to another, in search of new hunting grounds.

The Russian traders depended largely on the native peoples they encountered for their furs, as the French and English did in Canada, and as in Canada they cheated the natives, trading cheap tools and worthless trinkets for furs that would bring a fortune in distant markets. In Canada, however, the French and English were bitter rivals, inciting the Indians to bloody fratricidal warfare to secure their trade routes and sources of supply, reducing entire peoples to a pitiful remnant by war and disease, and so decimating the fur-bearing animals that by 1640 the beaver were virtually wiped out in the Iroquois country south of the Great Lakes. The Russians in Siberia had no European rivals in the fur trade, although eventually they did encounter resistance from the Buryat people, who had formerly sold their furs to the Chinese.

The direct source of the state's revenue from furs was the annual tribute payable in furs exacted from the native peoples,

the *yasak*. At first, while fur-bearing animals remained plentiful in an area, this tribute was less onerous than it became later as the highly prized sable disappeared and fox and other furs in demand became scarce in many regions. As the numbers of the smaller native peoples declined, ravaged by disease, the *yasak* became increasingly difficult for them to pay. Even the change made in 1728 allowing the *yasak* to be paid in cash did little for the peoples with a primitive hunting economy in the more remote areas, for they seldom saw currency in any form.

"Tyumen was founded on the fur trade, but later it became one of the first grain-growing centres in Siberia and a dairy-farming area," Larisa Sedykh told me at the Tyumen Museum. "I don't suppose many people know that butter from the Tyumen region was prized in Moscow and even exported to England at one time. Today we produce most of our own food, within the limits of the crops suited to our climate, and our greenhouse production is expanding."

Serious and pretty, dark hair swept back from her forehead, she told me she had worked at the museum since she graduated from Tyumen University with an historical-philological degree and she seemed to regard it as a book recorded in its exhibits, every one of which constituted a paragraph or a chapter she knew well.

Forty years after it was founded, Tyumen had a population of 157 outside the fort and 222 inside the fort, which could boast five churches, a monastery, 37 stores, seven smithies and a trading house which also served as a guest-house for merchants who came from Russia, Iran, Afghanistan, India and China, she told me.

Her eyes lighted up. "If you want to know what it was like 300 years after the city was founded, toward the end of the last century, you should look up a book entitled *Guide to the Great Siberian Rail Road*, which was published at St Petersburg—now Leningrad—in 1900," she said.

"The book is not very complimentary to Tyumen, but one thing it will tell you is that Tyumen did have a drainage system of sorts even a century ago." She pointed to a hollowed-out log on display. "That's a portion of the original drainage system. It was preserved by the water-logged soil.

"If the one-time governor of Tobolsk is to be believed, Tyumen was no centre of learning and culture in tsarist days. Tobolsk was formerly the administrative centre for the region that included Tyumen and around the beginning of the century the governor wrote to Tsar Nicholas II complaining about the ill-literacy and ignorance of the people of Tyumen. 'And a good thing too,' the tsar wrote back." "Now," she declared, "Tyumen has five institutions of higher learning."

On my return to Canada I obtained a copy of the *Guide to the Great Siberian Rail Road*, which was reprinted by a British publisher in 1971. Larisa Sedykh had been right. It was not complimentary, but it was probably accurate.

Even now, before the old town is rebuilt, the people of Tyumen would have difficulty in recognizing their city from that description.

CHAPTER II

Oil from the Muskeg

Driving through the pleasant countryside around Tyumen in the warmth of an early September afternoon, the birches already splashing the dark pines with the first gold of fall, it is hard to imagine these roads as they were in past centuries, hard and dusty or, after heavy rains, rutted and muddy, along which convicts trudged to their places of exile. For all of them, whether their offence was common crime or political opposition or merely the cruel whim of a landowner, Tyumen was the forwarding prison and, for the majority, this "gateway to Siberia" closed behind them forever.

Thomas Witlam Atkinson, an English artist who travelled through Siberia in the eighteen-fifties, has left in his *Oriental and Western Siberia: A Narrative of Seven Years' Explorations and Adventures* his impression of these exile convoys as he saw them.

He was on the road from Shadrinsk, about 160 kilometres southwest of Tyumen, to Ishim when around two o'clock in the morning "we came up to a large party of convicts marching into eastern Siberia—these unfortunates have a long journey before them.

"There were 97 in the gang; 17 men and three women in chains led the van, destined for Nertchinsk (north of the border of what is now Outer Mongolia), and have yet to march more than 4,000 *versts* (a *verst* is roughly equal to a kilometre). It will take eight months before they reach their place of banishment—they were a most desperate-looking set."

George Kennan, the American writer, visited Siberia close to 40 years later to gather material for his book, *Siberia and the Exile System*, first published in 1891. Describing his visit to the Tyumen forwarding prison in 1885, Kennan was appalled to find 160 prisoners crowded into a barrack room built

for 35 or 40. In the main building the cells contained from six to 30 prisoners and the air "was indescribably and unimaginably foul . . . laden with fever germs from the unventilated hospital wards, fetid odors from diseased human lungs and unclean human bodies, and the stench arising from unemptied excrement buckets at the ends of the corridors". Prison buildings that he considered hardly adequate for 800 actually were housing 1,800.

On the road, he wrote, the life of the convicts was made "almost intolerable by official indifference or fraud". Hundreds of men and women "fall sick on the road, and after being carried for a week, or perhaps two weeks, in jolting *telegas*, are finally left to recover or die in one of the *etape* lazarets between Achinsk and Irkutsk".

Kennan's book evoked outrage in Europe and North America when it appeared, but it left the Russian authors of the *Guide to the Great Siberian Rail Road* untouched, for they could write with implicit approval in 1900:

"The exile office of Tyumen, registering and regulating the exiles and their distribution throughout Siberia is an important and active institution. From 1823 to 1898, a period of 75 years, 908,266 persons have been registered by this office."

Brutal and callous as the Siberian exile system was, it had its counterpart in an English penal colony half a continent away.

The harsh conditions imposed on the Russian convicts sent to the Nerchinsk mines were duplicated in the Newcastle coal mines of New South Wales where, according to an account written by one of the first men to be sent there, "convict miners remained underground the whole week, and on Saturday afternoons were taken to the surface to wash themselves and their clothing in sea water. When their clothes were dry they were marched to the convict barracks and confined there until Monday morning. . . At the first streak of dawn on Sunday the prisoners were paraded in a yard, where a series of triangles had been set up, with a large corps of flagellators in attendance. . . The orgy of punishment continued hour after hour until not less than 50 men had been lashed, none with less than 75 stripes. . ."

In England men and women could be sent to the Australian penal colonies for crimes as petty as theft of a loaf of bread, or for the organization of an illegal trade union or for treason.

After the defeat of the uprising in the Canadas in 1837-38, 57 English Canadians and 58 French Canadians were sentenced to transportation to Botany Bay and Van Dieman's Land for treason and other crimes, the same penalty inflicted on 86 captured Americans for the piratical invasion of Canada and high treason.

In Russia landowners, by an edict issued in 1760, were empowered to send serfs to permanent exile in Siberia without a court trial—an edict rendered even more draconian in 1765 and again in 1767 by further orders allowing serfs to be sent to penal servitude merely for uttering a complaint against their owners.

Kennan listed those sentenced to exile under four headings. First were the *katorzhniki*, the hard-labor convicts. Next were the *poseleltsy*, the penal convicts. Third were the *ssyl'niye*, the persons simply banished, and last the *dobrovol'niye*, the women and children who went voluntarily to Siberia with their exiled husbands or parents.

Those in the first two categories, who bore the stigma of criminal for the rest of their lives, were deprived of all civil liberties and compelled to remain in Siberia for life. Whatever property they owned was declared forfeit to their heirs as though they were dead and their wives were free to marry again. Wives and children either accompanied convicts into exile or all family relations were severed.

Unlike the hard-labor and penal convicts who went to whatever places of exile the government decided wearing five-pound leg fetters and with their heads half shaven, those simply banished, whether by the government, a court or a village commune, were not shackled nor were their heads shaven. They retained some of their civil rights and could return to European Russia when they had served out their terms of banishment.

The peasants followed the Cossacks and the fur-traders into the Siberian wilderness. Some of them went involuntarily under sentence of exile. Some of them went clandestinely, seeking to escape the misery and degradation of serfdom. But often, although they could no longer be bought and sold, a form of serfdom followed them into the villages where they settled. There they found themselves working part of their time on government land, the produce from which the government took, and the rest

of the time on their own plots, from the produce of which they had to support their families. In time, however, compulsory work on government land was replaced by a tax known as the *obrok*.

Whatever they were and however they came, they were pioneers worthy of the Russian and Ukrainian settlers who emigrated to Canada in the opening years of this century, lived in sod huts and hitched themselves to the plow to break the virgin soil of the prairies.

On fertile plains and in river valleys, wherever soil and climate were favorable, they carved out the first farms and produced the first crops in a land which now has some of the largest and most modern farms to be found anywhere, as I was to discover.

Of the 379 persons given as the population of Tyumen in 1624, a total of 71 were listed as farmers. The primitive plows and tools they used, fashioned by the men who used them, are displayed in the Tyumen museum as a permanent reminder of how far agriculture has come.

What the peasants accomplished in opening the land, the political exiles achieved in founding schools and opening minds to new radical ideas.

"After the 1905 revolution many prisoners were sent to Obdorsk in the Ob River delta—it's now called Salekhard," Larisa Sedykh informed me. "One of them was N. M. Nemtsev, who became the first chairman of the Tyumen Soviet in 1918. Another was T. D. Semkin, who was killed by the whiteguards in 1921."

There is a photograph in the Tyumen museum that reflects the influence these political exiles had. It shows the log building in Tyumen beneath the floor of which was a secret underground room housing the printing-press that produced illegal newspapers and leaflets.

There are other photographs that tell of those now distant days when the people were fighting desperately to stem the advancing whiteguard armies. One of them shows the "barge of death" in which the whiteguards shipped their prisoners during the 13 months they held Tyumen and murdered them along the river route to Tobolsk and Omsk.

"The whiteguard commander in Tyumen was a Czech named Gajda," Larisa commented as I stopped to look at the photograph. "He was among those who escaped when the whiteguard armies were defeated. But he rose like scum to the surface again, during the Second World War—as head of the Gestapo in Brno, Czechoslovakia."

Some of the photographs were of the men who fought to the death to hold the railway station as the whiteguards seized Tyumen. One hundred and eleven Red-Guards retreated to the forests where they forged their own weapons to wage partisan warfare. These too are on display, mute evidence of the conviction and courage that upheld the Soviet state in its formative years.

When I paused at the Civil War memorial in a square off the Ulitsa Respubliki, there were fresh flowers at its base.

Of the many places I might have visited to obtain an insight into the lives of the citizens of Tyumen three generations after the revolution, I chose the mineral springs sanatorium at Taraskul because it would give me an opportunity to see a health spa which anywhere else would probably be a private resort restricted to those who could afford its expensive services. And after all I had heard of the sick left to die along the tsarist road to exile, it would be a pleasant contrast to see how a socialist state looked after the health of its people.

Taraskul lies on the outskirts of Tyumen and is fringed by woods of birch and pine and fir. It is still a typically Russian landscape—the dappled stretches of grass beneath the trees, and paths winding among them here and there. And that afternoon there seemed to be people everywhere, people waiting at bus shelters, people walking along the roads, people going into the woods with pails, obviously out to pick berries.

It was Lyalya who broached the subject of mushrooms. She had a craving for mushrooms and she had merely to mention them to evoke an interested response, for picking mushrooms seems to be a Russian pastime.

"The mushrooms were very good in Moscow this year," she remarked as we passed a group of women carrying pails. "How were they in Tyumen?"

"They were very poor here, very poor," someone replied. Then they all lapsed into Russian, speculating about the causes of good years and bad, and I will never know what they concluded.

The sanatorium at Taraskul was a big plain building, white stucco on a pink brick foundation, divided into two connected wings. Petunias and marigolds bloomed in ragged profusion in the grounds. An old woman in a blue sweater and flowered skirt, kerchief tied around her head, sat on a wooden bench immersed in a book, not even raising her head as we walked by.

Beyond the building a sandy track ran down to the lake through rough grass strewn with wildflowers, barred by a light birchwood barrier. Under the cloudless sky the water was a deep blue.

At the sanatorium entrance Dr Vladimir Sitnikov, the chief doctor and administrator, welcomed us warmly. A tall athletic man with a rugged face and high domed forehead, his enthusiasm for his work was contagious. Soon, a little self-conscious in ill-fitting white coats, we were following him through the process to which some 2,500 patients a day happily submit themselves.

I was a little incredulous. "Twenty-five hundred?" I asked.

He laughed. "Yes, that's how many patients we treat here every day."

But first we had to see the pool and taste the mineral water. He led us into a large central hall rising to the full height of the building. From the outside the building had not seemed impressive. But this was impressive indeed. I was reminded immediately of the Hotel L'Aeroport at Mirabel, outside Montreal, where I had stayed on my way to Moscow, which is built on a similar plan.

At the centre was the rock fountain and mineral water pool to which water was piped from the lake. Surrounding the pool were plants and shrubs beyond which seats were spaced at intervals. And around the walls were more seats, most of them filled with patients who seemed content just to sit and watch the water tumbling into the pool. Above us, white-coated figures appeared and disappeared through doors opening on to the balcony that curved around the hall.

Dr Sitnikov ran down to the pool and returned with a glass

of water. "Here," he said, holding out the glass, "taste this." He must have appreciated my approval. I drank the whole glass.

We started in the long narrow room along one side of which there were individual curtained cubicles. "This is where patients get the mud pack treatment," Dr Sitnikov explained. "I'll show you." He poked his head through the curtain, exchanged a few words with the attendant and opened the curtain. Inside a woman lay encased in a sheet from which black viscous mud oozed. Whatever reservations I might have about the mud treatment as a pleasant experience, she looked blissfully content.

When she had gone, Dr Sitnikov asked the attendant to demonstrate for us the vacuum system of retrieving the mineral mud from the sheet and returning it to a central tank to be reheated to body temperature. He was very proud of this system, "the most advanced in the country," as he impressed on us, and its speed and efficiency were apparent.

Step by step we followed him around the building, from one room designed specifically for pregnant women—"If a pregnant woman has any abnormalities, the mud treatment brings them out and makes diagnosis easier," he explained—to another room for persons with heart ailments for whom the full treatment might be dangerous; instead, the mud is applied to parts of the body by electrically warmed pads. For every kind of therapy, even musical therapy, there seemed to be a room with its own specially designed equipment.

I asked him how long the medicinal properties of the mud had been known. "For a long time," he said. "People living in an area get to know where mineral waters and hot springs are and use them locally. That sort of knowledge is handed down from generation to generation. I imagine the first primitive people to live here knew about this lake. It may even have been a sacred place to them. Now we have taken a wonderful natural resource, applied all our scientific and medical knowledge to it, built the facilities and made them available to everyone."

That night Dr Sitnikov invited us to have cocktails with himself and his wife, and for the first time I found myself plied with questions instead of asking them.

But I did have questions to ask of others, a lot of them. Tyumen, I knew, was the administrative centre of the Tyumen

Region, an area larger than any Canadian province or Australian state, stretching north to the Gulf of Ob and the Kara Sea, and the oil and gas centre of Western Siberia.

I got some of the answers in a discussion I had with Yuri Startsev, first deputy chairman of the Tyumen regional executive committee. He was quite forthright.

"The West tries to depict our oil industry as backward, lacking the advanced technology to drill beyond certain depths or make the same high recovery of oil, and therefore unable to make rapid progress without its technological aid," he declared. "The facts speak for themselves. In 1970 we produced 30 million tons of oil. Now we are producing more than 300 million tons, half the country's total production. And we are producing 162 billion cubic metres of natural gas, one third of the country's total production. Does that sound like a backward industry to you?"

I was sure he knew about the CIA study of Soviet oil and gas resources released in 1977 and widely published throughout the West. Any experienced Western journalist knows how stories can be "leaked" to the press, "planted" in one publication to be picked up as fact by other publications, and how figures can be juggled to produce the desired economic conclusion. But I decided to ask him about it anyway.

"In face of what you have just told me," I said, "how can the CIA maintain its claim that the socialist countries will become net importers of oil before the end of this decade?"

"That's a propaganda statement, not a serious study," he asserted. "Apparently it's not enough to misrepresent our oil industry as being technologically inefficient, now our output is about to start declining too." He paused, measuring his words. "The real purpose of that study was to create tensions in Soviet relations with the Arab countries, to spread the false impression that the Soviet Union faces an impending oil crisis and so justify U. S. military moves to forestall a non-existent Soviet threat to Middle East oilfields that the U.S.—not the Soviet Union—has declared vital to its interests."

He was scornful. "How can the CIA know what our oil and gas reserves are? We don't know the full extent of them ourselves yet. We have many potential oil areas to be drilled and

developed and we are continually making new discoveries. Our potential reserves are enormous.

"As for technology, you will see for yourself when you go to the oilfields that we are quite capable of producing our own. Our oil industry is highly computerized and automated. We use Western technology and equipment when it is available—we have Canadian all-purpose carriers and they are good machines—but we rely upon our own."

There are no differences among Soviet oil experts in predicting the future of the industry. Academician Zabel Aganbegyan is director of the Institute of Economics and Organization of Industrial Production under the Siberian Branch of the USSR Academy of Sciences. He knows Siberia well, for he has been working there since he was in his mid-twenties. Although I was not able to see him—he covers some 200,000 kilometres a year in his travels—he had already answered the question I would have put to him: Are Siberian oil resources becoming exhausted? His answer:

"The capacity of Western-Siberian resources is such that no stabilization of extraction rates can be expected yet. Sooner or later this will happen, but it won't be soon. I think that those who are predicting the decline of oil production in Western Siberia won't live long enough to see the day."

Aganbegyan gets impatient too with claims that Soviet technology is deficient, an impatience voiced in this statement:

"Meeting with my colleagues abroad, I am frequently surprised—to put it mildly—at the widespread and erroneous ideas about what is going on in Siberia. For example, the impression that Western Siberia's oil and gas are extracted mainly with foreign-made equipment. I assure you that our gigantic undertaking in Siberia, which gives us an excellent chance to judge the capabilities of Soviet-made machinery, is based completely on the use of Soviet equipment. The only imported machinery used here is the Caterpillar tractor, which is used in building gas pipelines and, experimentally, in the gaslift system at the Pravdinsk deposit, which is not a large one. In all other instances—sinking of wells to various depths, operations in our construction industry, building and operation of all transport facilities—the 'hardware' employed is Soviet-made."

My long and relaxed talk with Startsev gave me the opportunity to raise many questions, particularly the measures the regional administration is taking to protect what we both agreed was a fragile environment. As we ranged over the problems of muskeg and tundra, offshore oil-drilling in the Beaufort Sea, the Great Lakes, the inside waters of British Columbia's coast and the myriad rivers and lakes of the Tyumen Region, I found it was a subject close to his heart.

"We strive to protect the environment," he said. "Every oil installation has anti-pollution devices. Very little oil is moved by water and unloading is done away from rivers. Most of our oil is moved through pipelines and in the event of pipeline breaks or other oil spills, we have the emergency organization to contain them quickly and clean them up."

"If you get the chance to try them, you'll find we have very good fishing in our rivers and lakes"—it was almost an invitation and one I would have liked to accept—"and we want to keep it. We are determined not to create the acid rain and snow conditions that are killing off the fish in your Ontario lakes. In fact, as a result of the enhancement measures we have taken, our fish stocks are increasing. Just ask the people you meet at Nizhnevartovsk. But you won't even have to ask them—they'll tell you about the fishing."

In a few hours I would be on my way to the oilfields of the muskeg and taiga country to the north of Tyumen through which Cossacks and fur-traders had made their way without knowing the wealth of oil beneath the ground. Before I left, however, I wanted to see Konstantin Lagunov, chairman of the Tyumen branch of the Union of Soviet Writers and the author of two popular novels, *Red Roosters* and *The Bank Is Too Steep*, both having life in the oilfields as their theme.

I found him in his office, a short, shaggy man wearing dark glasses. "It's one of the great stories of Soviet achievement," he declared. "It has all the ingredients for several novels—hardship, determination in overcoming incredible difficulties, conflict, courage. I'm working now on the story of the Tyumen oilfields, not a novel this time, but a factual account of how the oil was won."

"Do you know that when the first pipeline was built the pipe had to be dumped in the river and carried, literally carried, out of the water and up the steep bank because there was no dock and the river boats couldn't get close enough to shore. That's how the first pipeline was built. You'll hear about it from some of the people who did it. Yes, it's a great story and it's still unfinished."

It was raining again when we left Tyumen and once again our flight was delayed. Valery had decided to go with us to Nizhnevartovsk and while he went off to see if he could get us another flight, I stood out on the open terrace watching the planes taking off and landing. At least they were flying.

After a considerable time Valery came back. He had contrived to get us on another flight. "Get your bags and follow me," he ordered us. "We'll be leaving right away." We carried our bags out across the field, past the row of standing planes to a small plane at the end. There we handed them over to be stowed away. I might have been taking off for a flight up the British Columbia coast or into the Yukon and my fellow passengers might have been miners, loggers and oil workers going back to the job.

From the air, as we neared Nizhnevartovsk, the landscape had a fascinating familiarity—the ever-changing pattern of the muskeg, russet and orange splashed with the green and blue of pools that merged into small lakes and broke again into pools; the dark stands of pine and fir streaked with the lighter green of birch, and through it all the broad ribbon of the Ob spilling across a grey horizon lighted by oil flares. It was as forbidding a country as any along the Mackenzie River, awesome in its desolation. Yet suddenly, there was the city in a shallow bend of the river, the thin lines of its roads thrust out across the swamps toward the flares.

It was still raining when we landed and it was colder than it had been in Tyumen. We stood around impatiently with the other passengers while the baggage was unloaded, and when we had all sorted ourselves out, a short stout woman wearing a red armband beckoned us to follow her to the exit. But there was no one there to meet us.

Once again Valery was dispatched to make phone calls. The minutes dragged by and after a while Lyalya went to look for him.

Soon Lyalya returned with the information that Igor Korsunsky, chief of the Nizhnevartovsk Communist Party Committee's political education department, had got tired of waiting for the flight we were supposed to be on and had gone inside the airport to keep warm. Within minutes he drove up with Valery in a mud-splattered minibus, offered a quick apology, loaded our bags, and we were on our way.

It was getting late in the day, but it made little difference. Except for the cleared arcs of the windshield wipers, the windows were covered with mud and silt and I could see no more than the blur of passing traffic. Eventually we drove into a courtyard and stopped before a single-storey building that I took to be a motel. In fact it was a guest-house, laid out much as a modern Canadian motel might be, but somewhat better furnished. I remarked that I had not expected to find such comfort in a frontier town. Translating Igor's reply, Lyalya pondered the right words. "He says that here in Nizhnevartovsk you will find they are very much with it."

He was right. The next morning when we set out to begin covering in three days a city and surrounding countryside that would have provided a busy three weeks, the minibus had been washed down and its windows cleaned. It was a nice gesture, but futile, for within a short time the windows were as dirty as ever. It had stopped raining, but the road was plastered with mud and wet sand.

Nizhnevartovsk is an incredible city—a young city of young people where the average age is 28 and the tempo of development has all the energy and enthusiasm of youth. It is a city still in the making, rough at the edges, too raw as yet to have acquired the polish of older cities that count their existence in centuries, not years. The foundations have been laid, boulevard trees and shrubs have been planted, provision made for squares and parks, but the present is always overtaking the future. Already the population is more than 125,000 and growing at the rate of 15,000 a year as people pour in to work in its expanding enterprises, so that a population figure is out of date soon after

it is reported. That rate of growth leaves little time and energy for polishing. New workers must be housed, kindergartens and schools must be provided for their children, recreational and cultural centres built.

In the meantime, the city has all the appearance of a boom town, but a boom town conforming to a plan. When it rains, water gathers in the low places, the swampy areas that have not yet been filled and built upon and spills over the sand shoulders of the roads, huge concrete slabs laid over a foundation of peat and sand.

The roads are rough, pounded incessantly by the heavy traffic they carry—trucks loaded with sand for fill, trucks carrying pipe and building materials, flatbed trucks hauling heavy equipment, tankers, mobile cranes, buses, jeeps, cars, even the occasional motorcycle and sidecar. Within the city the traffic moves slowly, cautiously negotiating broken pavement, gearing down as it moves out on to deeply rutted shoulders to allow another vehicle to pass. On the long flat stretches outside the city it moves faster, but the wear and tear on vehicles is just as heavy. Not once, however, did I see a vehicle broken down, testimony both to the durability of the vehicles and the efficiency of the mechanics in the repair shops.

Maintaining the roads in passable condition is an unending task. Water seepage erodes the foundation and the welded concrete slabs sink, chip and break. The welded rods snap under the strain. Entire sections must be lifted and replaced repeatedly, and detours are frequent. Looking over the swamps out of which the city has been reared, the marvel is that it has been built at all.

In Igor Korsunsky I found a man eminently suited to this frontier. I liked his readiness to dispense with time-consuming formalities in getting things done. He drove himself hard, operating his minibus like a mobile command post, continually using the radiotelephone, making and checking arrangements to ensure that we wasted no time. Still young, energetic, himself a former oil-worker, he seemed to embody the quickened pace of this oil city.

"What do you think of our roads?" he asked me with a grin after we had lurched and bumped over one stretch where the

concrete slabs had sunk and cracked and a road crew was already preparing to make repairs.

"Well, they're not exactly what you would describe as expressways," I remarked.

"They may not be expressways," he replied, "but you could build expressways elsewhere for less than these roads cost—1.2 million roubles a kilometre. How does that compare with the cost of your Canadian roads?"

The only road in any way comparable that I could think of was the newly completed Dempster Highway, which runs some 685 kilometres from Dawson City to Inuvik in the Northwest Territories, and I remembered from figures I had seen in a Canadian Arctic Resources Committee report that costs had been averaging around \$490,000 a mile on the last stretches built in 1979.

I did some quick calculation. "It's not that easy to come up with a figure," I told him. "You don't have to adjust your cost figures for inflation all the time—we do. When construction of our Dempster Highway started in 1971 costs per kilometre were considerably lower and those first sections couldn't be built for anything like the same cost today. As closely as I can estimate, the cost of the last sections was around \$306,000 a kilometre."

We all did some calculation and came up with the figure, at current exchange rates, of \$2.2 million a kilometre for roads in the Nizhnevartovsk area.

"Does that Dempster Highway run through swamp and permafrost?" asked Igor.

"Yes, in some places, although road materials usually were not far away," I said. "I recall that they had to rebuild one section because they failed to allow for the permafrost. But it's an all-weather gravel road and so rough in some parts that you need a four-wheel vehicle. It's not a concrete road like this"—we jolted over another stretch where the roadway was subsiding and I clung to the back of my seat—"even if it is rough," I added. Lyalya looked sad. Between the noise and our bouncing around, she was not finding it easy to interpret.

"Building anything around here is difficult," said Igor. "We get the sand for our roadbeds from the Ob and wherever we can find a sandhill. Sand for our building sites has to be brought



Tyumen. The Lenin Monument in the city's central square



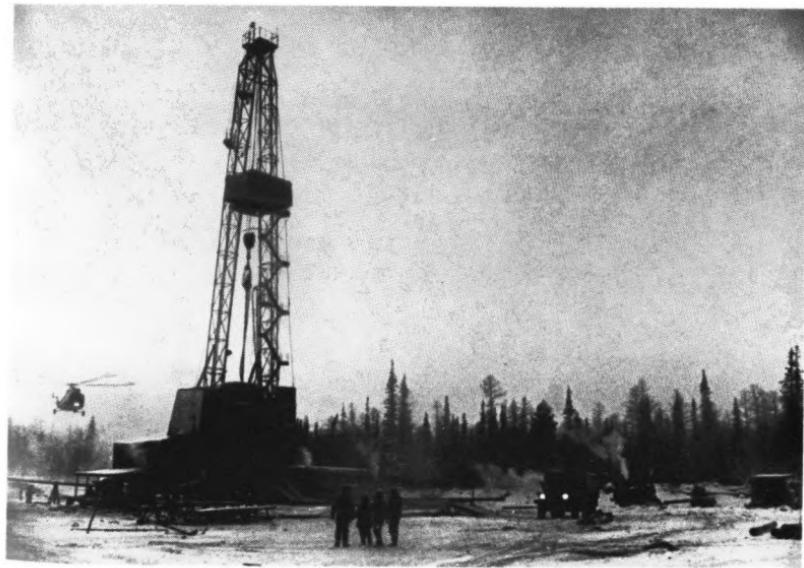
Nizhnevartovsk. One of the city's districts



Drilling foreman Grigory Petrov, Hero of Socialist Labor, Deputy of the Nizhnevartovsk City Soviet (extreme right), talking with construction workers



Nizhnevartovsk is a city of young people. Newlyweds traditionally visit the obelisk to the discoverers of the Samotlor oil deposit



In northern Samotlor



Academician Andrei Trofimuk. He is considered Siberia's top geologist



The computer centre of the automated control system for the excavation, preparation and haulage of oil and natural gas in Samotor



Powerful helicopters deliver equipment for oil prospectors



The last trips along the winter roads



Laying of the super-long
Urengoi-Center gas
pipeline

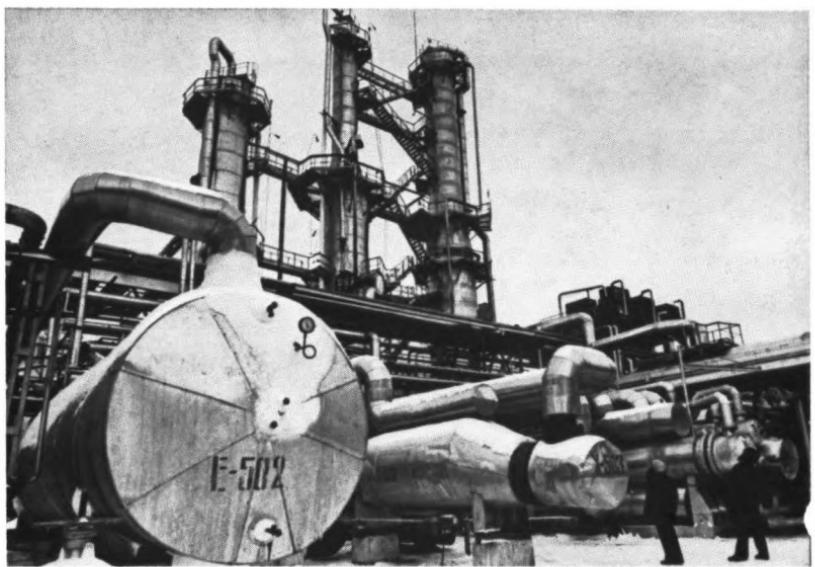


Engineer Vildanov is in
charge of the laying of the
Urengoi-Chelyabinsk
pipeline in the floodlands
of the Tura River



Control console of the installation for the comprehensive preparation of natural gas at the Urengoi deposit, one of the largest in the URSS





A sector of the complex for treating the condensate in Nizhnevartovsk



The airplanes and helicopters of the air medical service fly out at a moment's notice to the most distant reaches of the Tyumen Region irrespective of the weather

up the Ob by barge from other parts of the country. The closest source of broken rock is 2,000 kilometres away. It's costly, but already we've built 400 kilometres of roads.

"When we started building the city we were erecting four-storey apartment blocks. Now we're building nine-storeys and soon we'll be going to 16-storeys. And it all started in a swamp."

It all started in a swamp. Back in the thirties a Soviet geologist, Academician Ivan Gubkin, predicted that oil and gas would be found in the lowlands of Western Siberia. And in 1953 gas was tapped by the first well drilled in the vicinity of Berezovo, a village on the lower reaches of the Ob. That was the first of many discoveries over a vast area of the Tyumen Region, which is estimated to have 928,000 square kilometres of oil and gas lands, extending into the adjoining Tomsk Region. As the oil and gas deposits have been brought into production, such names as Nizhnevartovsk, Samotlor, Surgut and Urengoi have become familiar to Soviet readers everywhere.

To know how it had all been done, I had to talk to the men who did it.

CHAPTER III

Novosibirsk: Siberian Metropolis

I found Ivan Rynkovoy, deputy chief engineer for the Nizhnevartovsk oil and gas enterprises, surrounded by maps and plans and drawings—not an accumulation pushed aside for possible future reference, but the product of active use. A quiet-spoken man in his early forties, he is one of the oldtimers in Nizhnevartovsk, for he was there on the banks of the Ob before there was a city. Yet he speaks almost matter-of-factly about his first years, when test-holes drilled in the swamp proved the accuracy of Academician Ivan Gubkin's prediction in the early thirties that oil would be found in Western Siberia.

"There was a lot controversy over whether or not there was oil here and if there were oil, whether it was here in commercial quantities and whether it would be economically feasible to extract it because of the difficult terrain and the cost," he began.

"The first test-hole to produce oil was drilled in 1961. Three years later the decision to proceed with development was made.

"I headed a group of young engineers—I think all of us were in our twenties—who came to Nizhnevartovsk to begin work at Megion, about 40 kilometres northwest of here. It was a desolate area, some sandhills, but mostly swamp—water, clay and peat. In the spring it was flooded. You've seen for yourself that there is some forest around Nizhnevartovsk, but generally the swamps make the area accessible only by river or air except in the winter months when everything is frozen. Almost the entire area is swamp land—96 percent, if you want the precise figure. Although winter makes the swamps accessible, our winters are harsh, sometimes very harsh.

"When we started work we brought our equipment down the Ob from Tyumen by barge during the short navigation period and we moved everything we had to take out the same way.

"In 1965 the second field at Vatinsk was developed. That was

also our toughest year. A rumor went around that oil would not be found in the commercial quantities needed to sustain the development. Many of our workers quit and went to work in oil-fields elsewhere in the country. I was optimistic that the oil would be found. I believed the region had a great future and I wanted it developed so that we were ready for it. I was urging the construction of a railway station—and soon the railway will reach Nizhnevartovsk. But I'll admit that I felt depressed at times.

"Then we got word of the discovery at Samotlor. The doubters were silenced. It put new heart into everyone. There was a future here, but it still had to be brought into being.

"I was given the job of developing the new field. I called a meeting of the workers and I laid the facts before them. This was a raw field. The conditions would be rough, very rough, for they would have to sleep under the open sky, and the work would be hard. Then I called for volunteers, although I wondered, after my speech, whether I would get any at all.

"To my astonishment, every man in the meeting volunteered. From them I picked the 30 men I needed, mostly Communists, because more could be asked of them.

"One man I refused to take, Vasily Troyan, a Ukrainian who had been wounded at the front during the war. He came to me at the end of the meeting and told me flatly, 'I'm going.' I shook my head. He was a man of about sixty and I felt that the work would be too much for him under such harsh conditions. 'No,' I said, 'you are not going.'

"For three months that man hounded me, demanding to be allowed to go, until finally I relented. He provided to be such an outstanding worker that he was presented with the Order of the Red Banner. And when he was given the award, he chided me, 'You'll remember that you didn't want to take me.'"

As Rynkovoy related his story of those early days, his voice took on color, almost as though he were reliving them.

"It was hard work, really heroic work. In the daytime everyone worked at whatever had to be done. Engineers did workers' jobs by day and their own engineering work at night. There was almost no complaining because everyone knew what we were trying to accomplish. In fact," he added dryly, "we got far

fewer complaints then than we do now. Money was of much less concern. The work was the important thing.

"Our achievement was that we developed Samotlor so quickly that no other oilfield in the world has ever been brought into production in so short a time."

He lapsed into silence for a minute, reflecting. "Work does develop people, you know," he said. "I have seen for myself how young men grow as they are caught up in the spirit of the work. You have to be patient with them, of course, and give them careful guidance and instruction."

"I can think of one man in particular, Alexander Suzdaltsev. As a young man he was not too anxious to work at times and we often had to reprimand him. The north shaped him. Now he is a Hero of Socialist Labor."

Describing the technological problems encountered at Samotlor, he said the oilfield had been a testing-ground for oil technology.

"We tried everything, from the Soviet Union itself, from other socialist countries and from Western countries too, including Canada. Some of the equipment stood up well, some of it did not. We also had to invent new technology for ourselves. We learned from experience."

At the Oil Workers Technical and Cultural Centre in Tyumen, I had been intrigued by the model of a drilling rig mounted on an air-cushion platform employing the hovercraft principle. It had been designed by a research team at the Centre. The advantage of the machine, I was told, was that it could be towed by a single tractor, and that was required only to give the drilling platform direction. I asked Rynkovoy about it.

"Its use in the Nizhnevartovsk area is impractical," he explained. "There are too many trees. We don't need it here, but we shall use it farther north where the terrain is more suitable."

The development of Samotlor was itself a technological triumph. For the first time in the history of the oil industry anywhere, its planners used a computerized system to design and develop an entire oilfield. Equipment suited to a different terrain had to be modified and new equipment designed to meet the needs of swampland of which no one had any great experience.

The ability of Soviet scientists and engineers to rise to the challenge has its source in the Soviet educational system, its methods of enabling young workers to upgrade their skills and qualifications, and its encouragement of gifted students in their experiments and inventions.

I got an inkling of what this can produce when I went around the USSR Economic Achievement Exhibition in Moscow, in one of the pavilions, before I left the capital. To this exhibition young people from all parts of the country had brought their inventions and art. Their ages ranged from the late tens to the early thirties. Their work covered virtually every field of science and the arts. Like young people anywhere whose work has been selected from large numbers of submissions, they were eager to explain to me what they were doing and why they were doing it.

One young man with intent blue eyes and tousled black hair drew my attention. He was displaying some kind of automatic device and I stopped to examine it, wondering what it was. He smiled shyly. "What is it?" I asked.

He handed me a leaflet, which I promptly passed to Lyalya. She read it carefully and passed it back while the young man waited for the next question. "This is quite technical," she said, "but I believe it's a kind of automatic scanning device for measuring atmospheric radiation and light."

I was as interested in the inventor as I was in his invention which, it transpired, had won a high award. He told me that his name was Victor Oshlakov, his age was 31, and he was a graduate of the Tomsk Institute of Radioelectronics. I asked him how he first became interested.

Again there was that shy smile. "I was born in Kargasak, a village on the Ob in the Tomsk Region," he said. "My parents moved from there to the Altai Region where my father was an engineer at a power-station. I grew up around machinery. After the war there were few toys for children, so my father gave me parts of old machinery to play with. My interest grew from that."

Without opportunity, however, interest withers, and by providing every opportunity to its young people to develop their interests, Soviet industry has profited by many such inventions,

particularly in the oil industry of Western Siberia where new problems must be solved in new creative ways.

As we rose to leave Rynkovoy's office, we stood by the window for a moment contemplating the procession of trucks carrying construction materials.

"There are times," he mused, "when I can hardly believe that none of this existed until 15 years ago. Every year the city grows and changes. I remember that there used to be a small river around here. Now we've lost it. There's a nine-storey building where it used to be."

Then we were on our way again, another bone-shaking ride, to a drilling site out in swamps. Beyond the filled areas at the edge of the city, the bog crowded the road as an alien intrusion into its midst, the low thick cover giving it a deceptive appearance of solidity. But frequent stretches of trees indicated that there was some solid ground. Here and there sideroads built up of sand fill jutted into the swamp like ragged causeways.

"Drilling-site roads," explained Boris Tokarenko, secretary of the Communist Party's drilling workers committee, who was accompanying us. He too was a former oil-worker.

At the drilling-site we all crowded into the prefabricated shack which served as field office, so cramped there was barely room for everyone to stand. Clothes hung from hooks, boots were strewn around, brooms and pails stood by the door. The walls were covered with notices wherever there was room to pin them.

Hastily someone cleared a table for me. It faced a partition and this made it awkward for me to talk to the two men I had come to see and even more awkward for Lyalya, who had to translate leaning over my shoulder.

Both top drillers, both team-leaders and both holders of the Hero of Socialist Labor award, the two men were quite unlike in appearance: Anatoly Shakshin lean and wiry, his face seamed; Grigory Petrov broad-shouldered and rotund, his face scarcely lined.

Shakshin spoke with quiet pride. "Within a few weeks I will have drilled one million metres. And Grigory Petrov here will drill his millionth metre in the next few months."

"In an oil-worker's life," Korsunsky interposed, "everything

centres around the number of metres drilled. In the Bashkir Autonomous Republic, where I used to work, 40,000 metres was considered a great achievement in 1953. Now our top drilling teams do 100,000 metres."

"It was a proud moment for me when I was congratulated by the Central Committee of the Communist Party for having drilled 93,000 metres in one year," Petrov said.

In the fields around the Nizhnevartovsk area, oil is found at depths of some 3,000 metres, the two men told me, and they had another 1,000 metres of test-drilling before they reached oil-bearing strata.

Petrov asked Lyalya to tell him what I had written. "You had better add that we have both been in Western Siberia since 1964 and in Nizhnevartovsk since 1971," he said to me.

"Yes, I can remember the meeting at which Ivan Rynkovoy made his call for volunteers to go to Samotlor and the whole meeting responded," Shakshin said in reply to my question. "That was a most impressive moment, I can tell you, the most impressive I can ever remember."

The men who work in the oilfields, forever probing the wilderness for its hidden wealth, are well paid; yet for those like Shakshin and Petrov it is the quest, the achievement of finding oil and bringing in a new field that seems to offer the satisfaction. They take great pride in what their teams achieve because, as Shakshin told me, "With good team work, we can all accomplish more."

By Soviet standards their wages are high—1,000 roubles a month. Of that, they pay 13 percent in income tax. Rent and utilities cost them at the most five percent. And the prices of basic foods are stable. It leaves them with what in the West would be considered a good disposable income, reflected alike in the number of cars to be seen everywhere and in the demand for better quality and wider variety in consumer goods.

Oil workers have an eight-hour day, with two days' leave for every five days worked, and they get two months' annual vacation, time enough to spend at their own rest centre on the banks of the Vakh River or at a Black Sea resort.

As I said goodbye to him, I asked Shakshin where he lived when he was working in the field. He looked surprised. "Here

we go home to Nizhnevartovsk every night when we are working." Contemplating my own return trip over that road, appreciative as I was of the cost and difficulties of building it, I wished him well. "You get used to it," he said. "You wouldn't want to walk."

The number of people who waved us down on the way back emphasized his point. By the time we reached the city we had collected quite a load of non-paying passengers, including the two women we had seen on our way out carefully plodding into the bush with their pails. Wearily they dropped into their seats, heedless of the jolting. It had been a good day's picking and their pails were full of cranberries.

Now I wanted to see Samotlor, a name variously interpreted for me by some as meaning "heart of lakes" or "dead lake" and by others as "animal trap". "Can we go there by helicopter?" I asked Igor, thinking of the number of helicopters I had seen in the air that day.

"I'll see what I can do," he said. In less than an hour he returned to say that the helicopter was waiting for us on the pad.

Once more, as we rose, the strangely familiar pattern of the muskeg took shape beneath us and the flares in the distance grew brighter as we approached them. Then we were directly above Samotlor and, looking down, I was filled with admiration for the men who created it.

Samotlor was well named. In every direction small lakes, separated by treed ridges, lay like some huge irregular grid. And at their heart, its waters green, blue, pink and gold in the early evening light, was Samotlor.

Long causeways ran out from the shore into the lake carrying pipelines and power-lines. Far in the distance the road followed the ridges. It was a tranquil scene, the only sign of activity a truck driving along a causeway and a boat out in the lake, and it was all I would see of Samotlor. It was too late in the day to land and we had to turn back.

I got a fuller picture of the huge industry supported by the oilfields at Samotlor and elsewhere in the region from Vladimir Tatarenko, director of the Nizhnevartovsk Gas-Processing Plant, and Ivan Yashchenko, secretary of the Communist Party com-

mittee in what is actually a complex embracing several plants, when I met them the next day.

Four major pipelines carry oil, natural gas and dried gas from Nizhnevartovsk and, through an expanding network, gas from the Tyumen Region goes to West Germany, France, Italy, Austria and Finland as well as the socialist countries of Europe.

The gas-processing plant employs 1,500 of the 5,000 workers in the complex which, Tatarenko informed me, "is the largest of its kind in Europe, perhaps in the world". At the oilfield, what is known as concomitant gas, containing both gas and oil, goes from a separator through a collector to the plant, which purifies and dries the gas to remove what is left of the residual oil.

"Since this is not natural gas and it contains gasoline—it's very light, much like condensed gas—it must be purified," Tatarenko explained. "Oil chemical plants take this light non-stable gasoline to make fertilizers. Power stations and the metallurgical industry use the dried gas. We don't want to burn the gas, if only for environmental reasons. But it would be wasteful. It has too many uses."

The first section of the plant, raised out of the swamp like every other building in Nizhnevartovsk, went into operation three years after construction began in 1973 and, in Tatarenko's words, "since we had no experience, we had to research and experiment as we built. From the experience we gained, we were able to build the second, and the third and fourth sections, in one year each".

That experience was put to the test in the first months after the plant went into operation.

"The winter of 1975-1976 was hard. Temperatures as low as 57 degrees Celsius below zero seriously affected the plant's operation," Tatarenko continued. "People in the city suffered because there was no heating in many of the houses and some children had to be evacuated for a short time. Everyone who knew anything about welding was pressed into service to repair breaks. Despite all this, no one wanted to leave the city. Within two weeks we had overcome all the difficulties and the city was running normally again."

Workers in the gas-processing complex have come to Nizhne-

vartovsk from all parts of the country, some of them from similar enterprises, some with other industrial experience and others with little or no experience. I asked Yashchenko how a trained work-force had been built up in such a relatively short time.

"We have an in-plant training system," he said. "Young people are given simple jobs while they are studying for more advanced jobs. Some workers who came here with no trade are now highly trained leaders in their departments. We train our own specialists, some of whom go on to top posts in other plants. For instance, there is Sergei Potapov, who trained here at Nizhnevartovsk and now, at the age of 30, is chief engineer at Belozerny, not far away."

Tatarenko added the conclusion I was to hear time and again as I travelled across Siberia. "We find that the best leaders come from highly qualified workers who have been encouraged to study for still higher qualifications, aided financially by the enterprise while they are studying at an institute."

He might have added that full security of employment is a powerful incentive.

During the days I was in Nizhnevartovsk, supper was always an occasion. Igor made a point of inviting trade-union leaders, engineers and others to join us and Lyalya had to spend most of the time interpreting. And while Igor could readily disregard formality when he wanted, he held to the time-honored custom of offering frequent toasts, which meant that supper lasted some hours.

Our departure from Nizhnevartovsk was more like an evacuation. I was quite prepared to be told that the plane for Novosibirsk was leaving late and with that in mind, I was starting what I thought would be a leisurely lunch with Albert Radkin, an engineer and deputy chief administrator of the oil extraction section, when Igor got a phone-call. The plane was leaving early and was being held for us at the airport.

We left our lunch unfinished, grabbed our bags, piled them into the minibus and scrambled in after them. At the airport we drove right on to the field and up to the plane. The other passengers were all in their seats, waiting. But Albert Radkin was not to be denied his farewell. He insisted on carrying my bags aboard and having a last word.

"Next time come back for three months," he urged me. "We'll take you fishing on the Vakh . . . perch, pike, sterlet. The first time I put a line in that river I was reeling the fish in so fast they were piling up on the bank. We'll sail you down the Ob, right to the mouth. You'll see what a great river it is."

The stewardess tapped his shoulder. Unless he intended to go to Novosibirsk with us, he had to leave. He went, shouting from the door that I had to come back. Whether I do or not, it is not a country I shall ever forget.

Below us now was the Ob, glistening silver in the sun and winding in great serpentine coils through the taiga, 3,650 kilometres from its source near the border of Kazakhstan to the Arctic coast.

Of Siberia's four great rivers, the Ob, Yenisei, Lena and Amur, the Russians have known the Ob the longest, for the old chronicles tell of the battles fought along its reaches by the men of Novgorod in the eleventh century.

To John Milton, the great English poet, writing his *Paradise Lost* in the mid-seventeenth century, the Ob represented one of the farthest limits of the earth. Gleaning his knowledge from Richard Hakluyt's *Principal Navigations, Voyages and Discoveries of the English Nation*, published between 1598 and 1600, he gave the Ob as one of the places Satan sought to hide after his banishment from Heaven:

...then sought
Where to lie hid; sea he had searched,
and land,
From Eden over Pontus and the pool
Maeotis, up beyond the river Ob;
Downward as far antarctic...

The Ob was still below us when our plane flew over the city to land at Novosibirsk. Even here, 3,000 kilometres from its mouth, it was wide and bustling with river traffic, for it is navigable as far south as Biisk at the foot of the Altai range.

Until the construction of the Trans-Siberian Railway in the eighteen-nineties, what is now Novosibirsk was two villages, one on either bank of the river. By then water travel along the net-

work of rivers running east and west into the great northsouth rivers had long since been supplemented by a road system linking such towns as Tyumen, Omsk, Kolyvan and Irkutsk. The rivers, particularly the Lena, continued to be used for transport, by water after the spring break-up, by ice roads after freeze-up, but by the eighteenth century the road system was well established.

Keepers of post-stations spaced 20 to 40 *versts* apart were obliged to supply horses at a fixed rate for the transport of government officials and mail to the next station. Peasants were required to keep the roads in repair, always arduous work in the spring when the ice broke up on the rivers and flood waters spilled over low-lying areas. Natives who took up the postal service as their main occupation were eventually exempted from payment of *yasak* and in some places native settlements founded on the postal service grew up along the roads.

In winter, the preferred time for travelling, passengers and mail were carried in fast sleighs and in summer, in fast coaches called *kibitki* which far outdistanced the slow lumbering carts that were the only means of transporting freight between many places.

For almost two and a half centuries the system remained unchanged. But as Russia entered the second half of the nineteenth century, change was in the making.

It was the era of railway building, in Europe, in North America, and far-sighted men within and beyond Russia began to dream of building a railway into Siberia. Their arguments were given force with completion of the Central Pacific Railway to California in 1869 and the Canadian Pacific Railway to British Columbia in 1885.

The first to propose a railway was Nikolai Muraviev, Governor-General of Siberia, who had Colonel Romanov draw up plans in 1857 for a carriage road with the idea of converting it eventually into a railroad to run from Sofiisk on the Amur River to the Gulf of De Kastri in what now is the Soviet Far East.

Muraviev himself presented to Tsar Alexander II plans for a railroad from Chita to Irkutsk proposed by Percy McDonough Collins who, in 1856, was appointed U. S. commercial agent for

the Amur River and sought to form a company to promote the railroad. Doole, an English engineer, advanced the idea of a horse-drawn railroad from Nizhni-Novgorod to the Pacific, and Ferdinand de Lesseps, builder of the Suez Canal, had a plan for a railroad into Turkestan.

Arguments for building a Siberian railway ranged from securing Russia's eastern borders and development of its Pacific ports to filling its empty spaces with landless peasants from European Russia and tapping its resources.

The controversy engendered by the various proposals was reminiscent of that which preceded construction of the Canadian Pacific Railway during the same period. For years they were debated and discarded, but as banks, mercantile and other interests, sensing the opportunity for themselves, exerted their influence, the decision took shape.

Work on the single-track line began at both ends, on the Ussuri section out of Vladivostok in May 1891 and on the Omsk section out of Chelyabinsk in July 1892. Laboring with picks and shovels and wheelbarrows, thousands of workers, peasants, Cossacks and convicts cleared the right of way, built the roadbed and laid the rails. The convicts, working for a nominal wage, were encouraged with the promise that their sentences would be reduced. And in those places where convict and peasant labor was scarce, soldiers were put to work on the line.

Except for a few early mechanical shovels imported from the United States and used only in a few places, the men who built the railway had no machinery. The rugged winter climate and the terrain—taiga, swamp, and in the east, mountainous country—presented endless obstacles. But in little more than two years after it was started, the line was through to Omsk and by 1896 a regular train service was being operated over it.

The site originally selected for the Ob crossing was Kolyvan, then the largest centre in the area. When he reached Kolyvan with his surveyors in 1893, however, Nikolai Garin-Mikhailovsky, as talented an engineer as he was a writer, decided that the river there was too wide and prone to flooding in the spring. Spurning the financial inducements offered by the Kolyvan merchants, he chose a site 40 kilometres upstream where the two small villages stood and where, after construction of the rail-

way bridge was completed in 1897, the new settlement grew to become the city first known as Novonikolayevsk.

The Trans-Baikal section took another eight years to complete. Tunnels had to be drilled before trains could run around the southern end of Lake Baikal. Until this work was finished in 1905, trains had to be carried across the lake to the rail line on the eastern side aboard an ice-breaker ferry built in England, transported over the railway in sections and assembled with difficulty on site.

Finally, in 1916, with construction of the Amur line from Khabarovsk to Chita, the Trans-Siberian Railway, spanning 7,416 kilometres and the longest in the world, was complete.* Despite the limitations imposed by light rails that restricted the number of trains to eight a day and their speed to 24 km an hour, it was an engineering triumph. Instead of in months, the distance between Vladivostok and Moscow could be covered in two weeks.

The Trans-Siberian Railway opened the territory to settlement on an unprecedented scale. This was no longer the inhospitable wilderness, the dreaded place of exile, but a frontier offering new hope. Lured by grants of land and reduced rates on the railway over which they travelled in special fourth-class cars, much like the colonist cars provided for immigrants by the Canadian Pacific Railway, four million landless peasants went to Siberia, doubling the population over the 20-year period 1895-1914.

Along the narrow belt served by the railway, old towns were given new growth and new towns sprang up. Novonikolayevsk, destined as Novosibirsk to become the largest city in Siberia, the third city in area and the eighth in population in the Soviet Union, was one of them.

Soon after arriving in Novosibirsk, I read, in a brochure offered in four languages at the Hotel Novosibirsk, Lenin's view of the surrounding countryside as given in a letter he wrote to

* A reference to the completion of the last section of the Trans-Siberian Railway on Russian territory. Earlier, in 1904, the Chinese Eastern Railway had been built to link Siberia with Vladivostok by the shortest possible distance across Manchuria. (*Editor's note.*)

his mother from Ob station on his way to exile in 1897 at Shushenskoye, a village in the Minusinsk region. Today Novosibirsk terminal station stands on the site of the little Ob station and the thriving collective farm at Shushenskoye is the living substance of the theories Lenin shaped during the three years he spent in the village founded by peasant exiles in the eighteenth century.

He described it in a letter to his sister as "a big village with several streets, rather muddy, dusty—everything as it should be. It stands in the steppes—there are no orchards or greenery of any kind. The village is surrounded by dung, which the people here do not cart to the fields but dump outside the village, so that if you leave the village you always have to pass through a certain amount of dung".

And in the letter to his mother he wrote: "The country covered by the West-Siberian Railway that I have just travelled throughout its entire length (1,300 *versts* from Chelyabinsk to Krivoshchokovo—three days) is astonishingly monotonous—bare bleak steppe. No sign of life, no towns, very rarely a village or a patch of forest—and for the rest, all steppe. Snow and sky..."

Nevertheless, beyond the bleak landscape on which he looked out, he saw Siberia as "a wonderful country with a great future".

As evidence of how far Novosibirsk has come toward that future, Alexander Mikhailov, the city's chief architect, showed me some old photographs taken in 1913 when the population was less than 70,000.

The only recognizable building was the ornate old trading centre, with its arched white-stone columns framing the red brick exterior, erected in 1910 and preserved as the city's first stone building. There was little imperial grandeur about Novonikolayevsk Avenue, the main street, a dreary succession of two-storey wooden buildings lining a muddy thoroughfare. Renamed Red Avenue after the revolution, it has been transformed into a broad artery running ten kilometres through the city, its boulevards shaded by a variety of trees—birch, cork, fir, hawthorn, maple, mountain ash, pine and poplar.

Pulling out maps, plans, drawings, constantly pushing his long

grey hair back from his face as he pored over them pointing out the details, Mikhailov spoke animatedly about his concept of the city's future.

On his desk, neatly aligned, were squares of polished marble. "Yes," he said as I examined them, remarking on the range of colors, "those are from a place not far outside the city. It's quite a remarkable source because of the variety of colors. We haven't really developed it to any extent, but we intend to use it for our new metro stations."

"You are building a metro?" I asked.

He took a map from the wall. "We're just starting. See, here are the different routes, each marked in a different color."

The metro will be built in three stages, the first to be completed in 1985. It will run from Marx Square on the south side of the Ob, crossing the river on its own three-kilometre bridge—like the metro bridge in Moscow—and north under Lenin Square at the city's centre to Kalinin Square. The second and third stages will serve the west and east areas of the city, with transfer points to the main line.

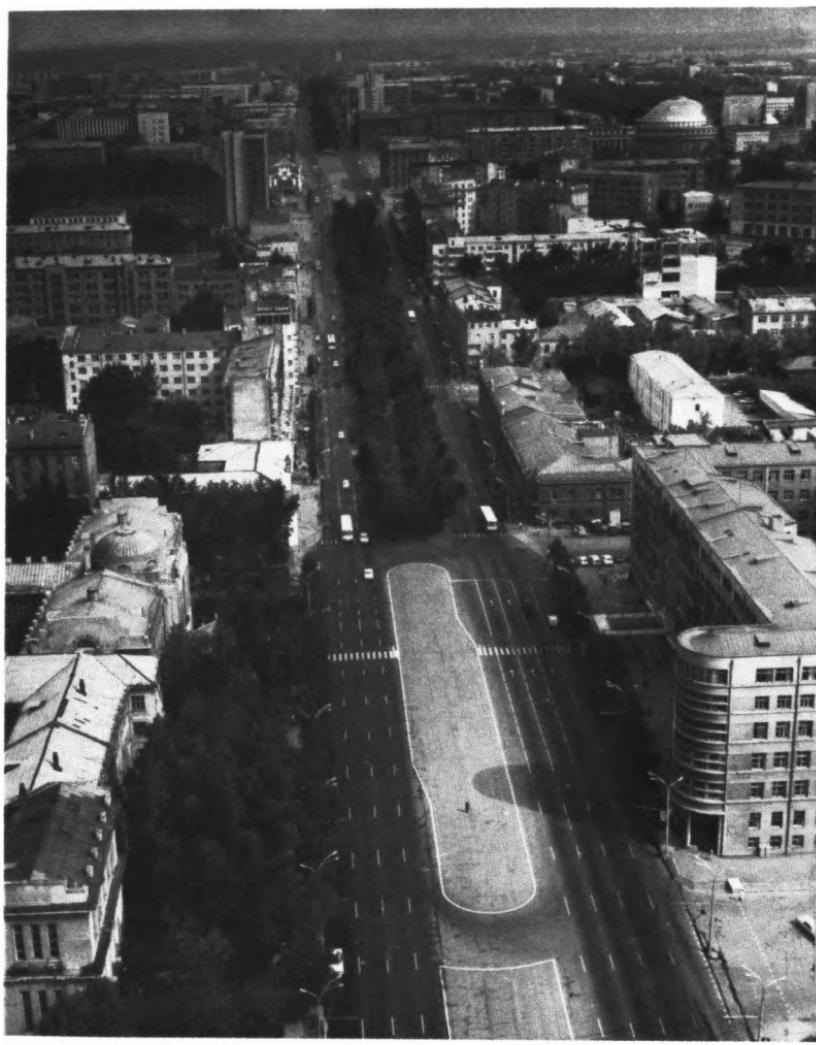
"Eventually the first-stage main line will be extended northward, which means we shall have to move the airport somewhere else, and an entire new district will be created," he explained.

When I asked him if he had thought of including an underground shopping mall as part of the main metro station in view of the severe winters, he said he had seen underground shopping malls in Montreal, Toronto and Vancouver when he visited Canada to take part in a symposium and the idea had occurred to him.

"Later, perhaps," he suggested, "but immediately people are impatient to have the metro and you can't blame them. Travel here can be difficult in winter. We have a good surface transit system, but when the temperature drops to 40 or 50 degrees Celsius below zero, sometimes with strong winds, it's much more pleasant below ground. The first thing is to build the metro and we shall have problems enough as it is—it will be the first in such a rigorous climate."

A metro, however, is just one of the projects Mikhailov has on the drawing board. Another is a stone embankment along

NOVOSIBIRSK



Krasny Prospekt—the city's main thoroughfare



The State Academic Theatre of Opera and Ballet



The Novosibirsk Institute of Electrical Engineering.
The Lenin Monument in the foreground



The new complex of Sovietskaya Sibir Publishers



The river terminal



A new household appliance store



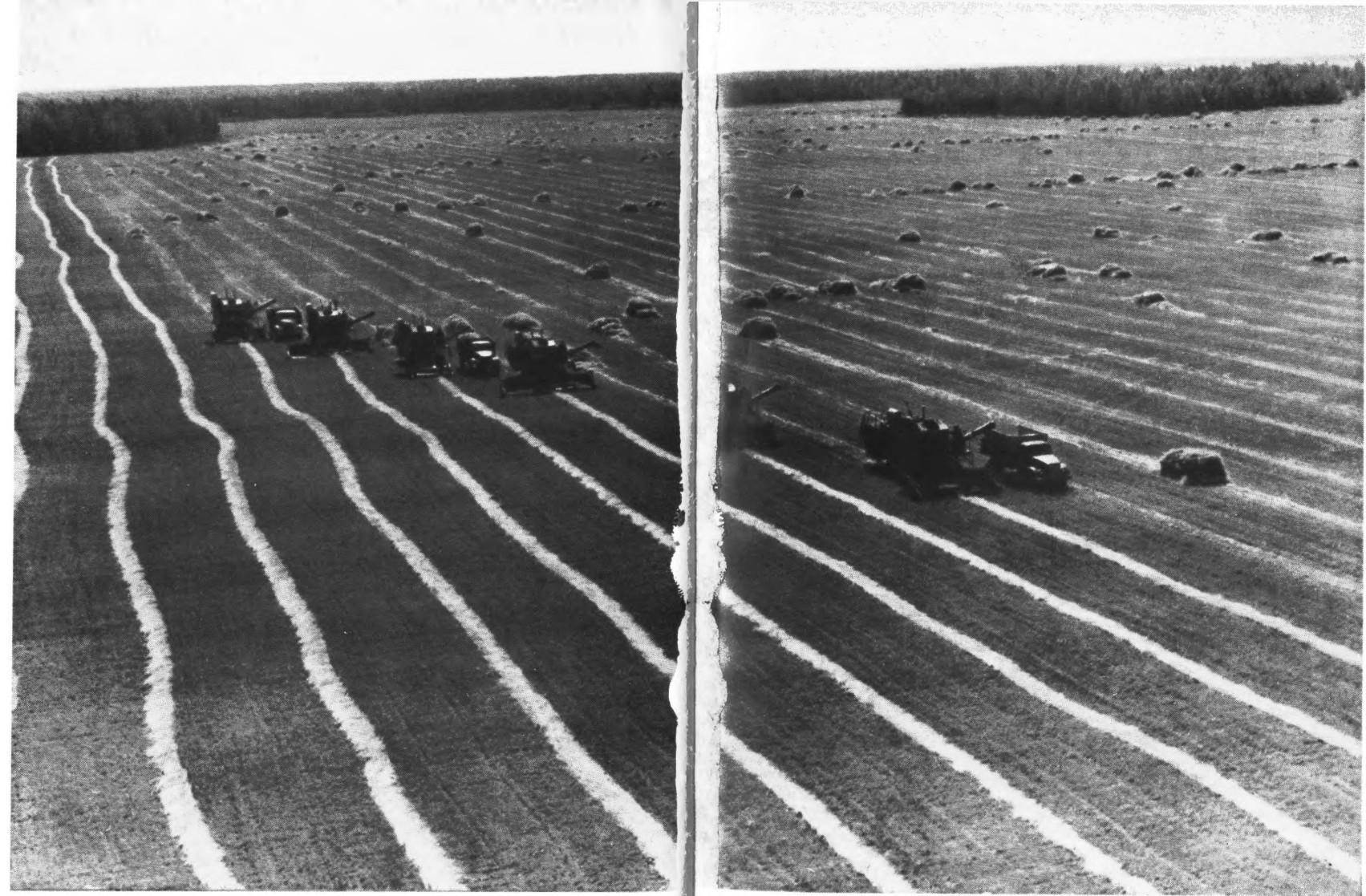
Akademgorodok. The computer centre in foreground



The science town of the Siberian Branch of the USSR Academy of Agricultural Sciences



Panorama of the pig-breeding complex (Omsk Region), one of the largest in Siberia



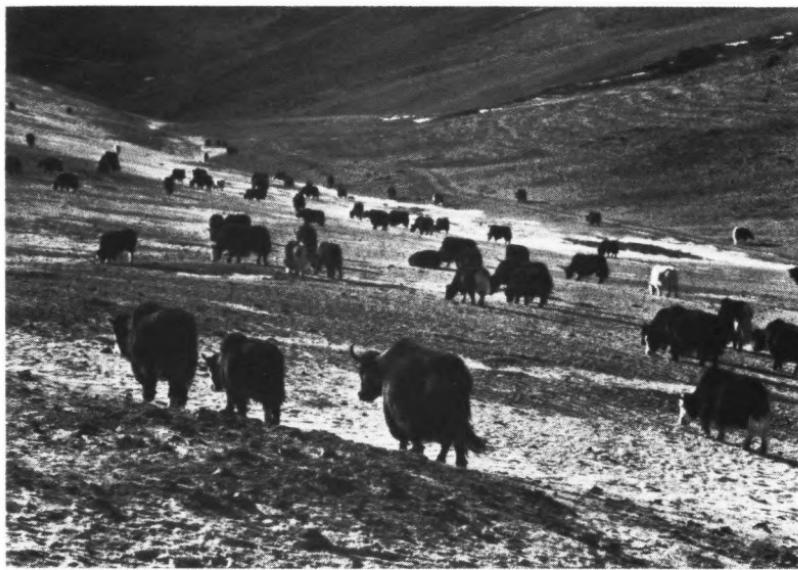
Siberia's fields are vast



Northern reindeer—a treasure of Siberia



Cedar nuts, the “bread of the Taiga”



Yaks are bred on many of Siberia's farms. These animals graze on pastureland all year round



Oblepikha is called the Siberian balsam. Its berries are rich in vitamins and used in preparing tasty juice and medicinal oil



Nanais, traditional hunters, returning with fine trophies

the Ob waterfront, on which work already is under way, and its complement of hotels and other buildings. New districts mean new schools and parks, and I had seen the new apartment blocks going up around the outskirts.

Past, present and future all were represented on Mikhailov's office walls—photographs of buildings already completed, some years ago, some recently, like the riverport passenger dock and the circular glass and concrete circus building, and alongside them architects' drawings of buildings and entire projects still in the future.

As we left I remarked, "It must be nice to build a city according to a master plan—no private developers trying to get their land rezoned for a quick profit and no private corporations riding roughshod over citizens' protests to put an industrial plant where the planners say it should never go."

He nodded his agreement. "In 1968 we planned for a city of 1.3 million in 1980 and that's our present population. Now we're planning for a population of 1.85 million in the year 2000. When you can plan properly you can get results, although occasionally you may wish you had done things a little differently.

"For instance, you've seen our State Theatre of Opera and Ballet, which has a stage as large as the Bolshoi Theatre's in Moscow. It's one of our landmarks and it has a special meaning for us because it was built during the war—that's how confident we were of victory. When victory came in May, 1945, just after the building was completed, we celebrated it by staging Glinka's opera *Ivan Susanin*. But," he concluded ruefully, "it was designed as a drama theatre and the acoustics are unsatisfactory."

Garin-Mikhailovsky, whose choice of a bridge site founded a city, epitomized the aspirations that socialist generations are bringing to reality. "Russia is such a fortunate country," he wrote. "So much interesting work to be done, so many magic possibilities to be realized and complex tasks to be solved. I've never envied anyone in my life, but I envy the people of the future..."

Novosibirsk today would arouse his admiration.

From Alexander Mikhailov, the architect whose physical imprint on the city is strong, it was a logical step to Nikolai Bez-

ryadin, the editor-in-chief of *Soviet Siberia*, which is the most widely read of all the newspapers originating in Siberia.

Few newspapers can claim such turbulent beginnings. It was founded at Chelyabinsk in 1919 during the Civil War and it travelled with the Red forces, publishing at the front; as they wrested from the whiteguards the towns they had seized.

Novosibirsk itself was under whiteguard occupation for 18 months. Soviet power was established there within weeks of its being proclaimed in Petrograd. Six months later, on the night of May 26, 1918, whiteguards and counter-revolutionary Czech forces organized its overthrow and opened a reign of terror, arresting and executing whatever members and supporters of the Soviets they could find. When the Red Army liberated the city from Kolchak's retreating forces on December 14, 1919 it found that the whiteguards had taken a last vengeful toll of the workers and peasants they could not defeat. Within the prison and in the courtyard were the bodies of the prisoners they had tortured and killed before they fled.

Today, in the Heroes of the Revolution Garden, the sculpture of a hand holding a torch thrust out of riven rock—a monument powerful in its symbolism—stands on the common grave in which the dead were buried.

Soviet Siberia went to Novosibirsk with the Red Army and it has been published there ever since. The book devoted to the 50th anniversary of establishing Soviet power in the city, which Bezryadin presented to me, is a distillation of the city's history extracted from issues published over the half century from 1919 to 1969.

"Of course, *Soviet Siberia* is just one of a number of newspapers published in Siberia," Bezryadin, who himself is Siberian born, told me. "Here in Novosibirsk, as in other major Soviet cities, we have simultaneous publication of the central newspapers—*Pravda*, *Izvestia*, *Trud*—photo-transmitted from Moscow. The total circulation of all newspapers published in Novosibirsk is 2.5 million daily, of which *Soviet Siberia* has 250,000. With our population of 1.3 million, that means everyone reads at least one newspaper and many families two or three newspapers a day."

Everyone in the Soviet Union reads, it seems. You see peo-

ple reading in parks, at bus stops, on streetcars and planes, in hotel lobbies.

Where else can you see a line-up outside a bookstore? In New York or London perhaps, when a book appears after lavish television and newspaper promotion, usually at a cost in inverse ratio to its literary merit. Soviet writers, however, sell their books on the reputation they have earned with their previously published work, whether in the many literary journals or book form, and on the strength of reviews. Publication of a new book by a popular author is almost a summons to a line-up. Despite the initial large edition, it will soon be sold out.

CHAPTER IV

Old Siberians and New

Few foreign writers have visited Novosibirsk without making some reference to it as the Chicago of Siberia. "But why Chicago?" I asked Anatoly Nikulkov, the editor of *Siberian Lights*, when he called at the hotel to see me one evening. "After all, Chicago has had many faces. There was the Chicago of the stockyards depicted by Upton Sinclair in his novel *The Jungle* and the Chicago of Al Capone and organized crime during prohibition. There was also the Chicago of Haymarket Square, the frame-up and hanging of Spies, Fischer, Parsons and Engel, and the struggle for the eight-hour day out of which May Day emerged as the international workers' day. There was Chicago, the birthplace of the U. S. Communist Party. And there was Chicago as Carl Sandburg saw it—crooked and evil he called it—in his *Chicago Poems*."

I groped for lines memorized long ago, but all I could recall were: "Laughing the stormy, husky, brawling laughter of Youth, half-naked, sweating, proud to be Hog Butcher, Tool Maker, Stacker of Wheat, Player with Railroads and Freight Handler to the Nation." Those lines captured the early spirit of Chicago, but they were not the lines I wanted. I gave up the effort.

"Except that both are great inland cities on rivers, both industrial centres, I don't see the basis for comparison," I concluded.

"It all started in the pages of *Siberian Lights*," Nikulkov said, interrupting his story to explain that his monthly literary journal, founded in 1922 and published by the Novosibirsk branch of the Union of Soviet Writers, consistently promotes the work of promising young writers. "In 1928 a young poet, Pavel Vasiliev—he was only 18 at the time—wrote a poem in which he envisioned 'Siberian Chicagos rising amid the taiga'. The poem

caught the popular imagination. It wasn't a direct reference to Novosibirsk, but during the thirties Novosibirsk was often referred to as Sib-Chicago.

"Remember, in the twenties we were slowly reshaping our country out of the wreckage left by the Civil War, laying the foundation for what you see now. Chicago was the great U. S. industrial city, a transportation hub like Novosibirsk. We wanted to build Novosibirsk into a great industrial city too. That's where the comparison ended. We have our own great working-class traditions. We were going to build a planned city in a socialist society. You can judge for yourself how well we have done."

Judging by what I saw at the Sibelectroterm Plant, the only industrial enterprise I had time to visit, Novosibirsk is doing extraordinarily well. Out of the huge coal and iron resources of the Kuznetsk coal basin to the east and south it has created an engineering and heavy machine-tool industry equal to any in the world—steel-smelting furnaces, lathes, turbo-generators, hydraulic presses. And it has all been done in a few decades.

A pleasant drive to the outskirts of Novosibirsk past industrial plants interspersed with residential areas set well apart in semi-open country brought us to the Sibelectroterm Plant, a series of buildings ranged behind the long white administration building housing the offices, design and other departments.

Inside, surrounded by engineers, all experts in their field, I was prepared to accept their statements of the plant's capacity to produce plasma and electron beam furnaces, electroslag remelting units, ore heat-treating furnaces and arc steel-making furnaces. The complex of huge shops with their banks of automatic and power-controlled machines, their maze of steel ladders and walkways dwarfing the operators at the consoles, was proof enough. I was more conscious of the fact that in all western Canada, a territory whose equally rich natural resources are shipped raw to the U. S. and Japan, there is no such plant and I had no basis of comparison.

When it came to discussion of the human values, the way workers feel about their jobs which determines efficiency and productivity, I was on more familiar ground.

Vadim Zavyalov, a chief engineer, told me that the Sibel-

electroterm complex of three such plants, the newest at Novosibirsk and the others at Tyulgan in the south Urals and Biisk, employs 6,000 workers, of whom 2,500 are at Novosibirsk.

The work week is 41 hours, the average wage 200 roubles. Eight percent is deducted for income tax from earnings of 100 and 13 percent from earnings above 100 roubles. Fringe benefits include a day care centre and kindergarten staffed by trained workers at a cost to workers of 10 to 12 roubles monthly, rest centres for workers and their families, and vacations at Black Sea resorts and elsewhere for which the trade union of the enterprise pays 70 percent of the cost.

Mindful of the questions I would be asked on my return by my wife and youngest daughter, herself an industrial worker, about how far the Soviet Union has progressed toward resolving women's "double burden" of work in industry and at home, I asked Zavyalov how many women worked in the three plants.

"About 2,000," he replied. "Most of them are in engineering and design. Others work on cranes as engineers or on assembly lines as machinists. But women are not allowed to work on jobs classified as heavy work."

My next question seemed to amuse him. "Fine," I said, "now I would like to talk to one of your women workers, some one picked at random from engineering or design because that would be least disruptive."

One of the young engineers hurried out and returned a few minutes later with a woman wearing a white smock who looked a little flustered at this sudden invitation to discuss her personal life with a foreigner.

That is how I met blonde, blue-eyed Valentina Kemina, aged 42 and a very pleasant and intelligent person. I asked her if she minded my asking her questions which, had we met casually, she might regard as an intrusion into her private life, and told her why I was asking them.

"Why should I mind?" she replied with a smile.

I asked her how she became interested in engineering. She said she had studied at the Radio-Technical School in Novosibirsk and afterward worked for a while at a radio-technical plant. When the Sibelectroterm Plant was opened in 1955 she applied for a job there.

"As the plant grew, I found I needed to know more and more about the work and that's how I became interested in getting my qualifications as an engineer."

"Didn't you find it hard, studying and trying to do the cooking and housework around your apartment?" I pressed.

"Sure, it was hard. But I was paid by the plant all the time I was studying to become an engineer and I also got two months' paid leave while I was preparing for my final examinations."

Zavyalov hastened to explain that the plant maintained its own technical and vocational school where boys and girls learned trades and which prepared them for further studies at higher institutes.

"They get paid both when they are attending the school and when they are enrolled at higher institutes," he said. "Most of our engineers started as production workers and obtained their qualifications on the job. The type of work they do and the complex equipment they have to use requires high qualifications. Our technology is so advanced, some of it the most advanced in the world, that all our engineers have the right every three years to study for still higher qualifications . . . on paid leave, of course. We have 2,000 engineers in our plants now and we would like to have more."

I returned to Valentina Kemina. "How did you manage when your son was small?"

"My husband is a shop engineer at the plant and with both of us working, naturally I was concerned about him. Having the day care centre and the kindergarten made all the difference. He got the best of care and I had no real worries."

After she had told me that they had a three-room apartment—kitchen and bathroom are not counted as rooms in calculating living space—in one of the residential areas we had passed, I asked her, "Who does the housework?"

"When I was studying to become an engineer, my husband and my son both helped with the housework—under my direction, of course," she replied good humoredly. "Now our son, who is a student at the Electrical Technical Institute and will go to work at the plant too when he graduates, does the housework. But I do the shopping. We have our appliances like a washing-

machine and a vacuum-cleaner and we have a car, which makes things easier."

I had asked my questions and got my answers. I thanked her and she returned to her work in the design bureau, no doubt to tell her colleagues all about the questions she had been asked by the curious Canadian.

Zavyalov, who went to Sibelectroterm after he graduated from the Institute of Energy in Moscow, and Andrei Pomeshchikov, chief engineer of the design bureau who has been named a Merited Designer of the Russian SFSR, were inclined to be philosophical about their work as I said goodbye to them.

"When we started work here we used to regard ourselves as a group of young engineers. Now, well, we're in our forties and we can hardly say that any more," Pomeshchikov observed. "We have grown with the plant, we enjoy our work and for us Siberia is the place to live. What more is there to say?"

The resources being used to supply Sibelectroterm and a widening range of industrial complexes in the new Siberian cities are incredible in their richness and diversity. The Russians have many sayings and my knowledge of them is extended every time I visit the Soviet Union. None is more apt than the saying that when God was flying over Siberia his hands became frost-bitten, forcing him to drop all his treasures.

Tsarist regimes knew something about these resources for more than two centuries through their administrators on the frontier, who in turn learned about them from the native peoples. Not until the Trans-Siberian Railway was built, however, was any great effort made to exploit them and then largely for the profit of foreign companies operating through their Russian counterparts. Still Siberia remained poor, its people scratching for a living amid the potential wealth of its soil and forests.

With half of the world's known coal reserves, the world's greatest forests, almost all the precious and rare metals and immense deposits of the base metals, the question for the economic planners is the pattern of development and what must be given precedence within that pattern.

"Not everything can be done at once," observed Prof Valery Makarov, chief science secretary of the Siberian Branch of the USSR Academy of Sciences and deputy director of the Institute

of Mathematics, when I talked to him at Akademgorodok, the "city of scientists", about which Mikhailov had told me. "Everything entails a big investment, the allocation of materials and equipment, the employment of scientists, engineers, skilled workers. It has to be considered as part of the whole and how it will advance the whole."

Makarov insisted on speaking English and he spoke it well, pausing occasionally while he considered my questions and sifted his vocabulary for the word to fit his answer.

The growth rate of the Soviet economy as a whole, he pointed out, is four percent, but for Siberia, which produces ten percent of the Soviet national income and accounts for eight percent of its machinery output, it is 5.5 percent. And, he added confidently, "I expect the Siberian growth rate to continue above the rate of the country's economy as a whole."

Like Yuri Startsev in Tyumen, he dismissed contemptuously any suggestion that Soviet oil production would start declining within the decade.

"We know we have oil in Eastern Siberia," he declared. "We are already producing it along the Lena. We know we have natural gas. We are already using it. What we don't know is how much oil and gas we have. Before we can know that we have to increase exploration in potential areas. Our problems in the north of Eastern Siberia are the same as in Canadian north. Can anyone say what the extent of the oil and gas resources of the Canadian north are, except for those that have been proven?"

More than any other achievement perhaps, Akademgorodok epitomizes the difference between the old Siberia and the new. In this city of broad tree-lined avenues and quiet side-streets, well-spaced apartment blocks and garden villas, a new world centre of learning is taking shape. As the seat of the Siberian Branch of the USSR Academy of Sciences, its only purpose is scientific research and experiment in fields ranging from archeology to nuclear physics, geophysics to cybernetics. Of its 75,000 people, one third are scientific workers. Even its location to the south of Novosibirsk, by the Ob Sea, is symbolic of the new Siberia, for the Ob Sea is the great reservoir created by the Novosibirsk hydro-electric dam on the Ob River.

Not long before I left for Moscow I had received from the

University of Alberta a book compiled from papers presented at a symposium held at Vancouver in August 1975 under the title subsequently adopted for the book, *Early Man in America from a Circum-Pacific Perspective*.

In itself the conference was an expression of the international exchange of ideas and cooperation so essential to answering the question: How and when did the first people reach America? The answers lie on both sides of the Bering Strait, in Eastern Siberia and the Soviet Far East, in northern Alaska, the Yukon Territory and Mackenzie District, and along the Aleutian Islands down the coasts of British Columbia and California. The only boundaries for ancient man following the game herds into a new continent were the physical barriers he could not surmount. The barriers for the archeologists seeking their traces 40,000 and more years later are the impediments to scientific cooperation.

Through papers presented at the conference, Canadian and American scientists, some of them specialists in Japanese and Chinese archeology, and scientists from Siberia and the Soviet Far East presented all the known evidence yielded by patient excavation, advancing their theories and arguing their conclusions.

I made a note of the names of the Soviet scientists, determined to see them if I got the opportunity. When I asked about them at Akademgorodok, I was told that one, Anatoly Derevyanko, had gone to a new post. I was disappointed, for his had been one of the bolder presentations to the symposium, suggesting that from the evidence of more recent discoveries in Siberia and the Soviet Far East, the first man to reach the Americas may not have been *Homo sapiens* but "a more ancient creature . . . already possessing clearly expressed *sapiens*-like features" who crossed the Bering land bridge more than 35,000 years ago.

Another whose paper was presented at the conference, Yuri Molchanov, an archeologist at the Yakutsk filial of the Siberian Branch of the USSR Academy of Sciences, was somewhere out in the wilds and no one knew when he would be back. But I could see Academician Alexei Okladnikov, director of the Institute of History, Philology and Philosophy, the dean of Siberian archeologists.

Okladnikov has spent a lifetime combing the coasts, the river valleys and lakeshores of Siberia sifting from ancient dwelling

sites and camp-fires the pieces of worked bone and stone that mark the passage of man across Siberia and ultimately to the Americas. Despite his years, the lure of the field is as strong as ever. In 1973, as the Soviet writer Leonid Shinkaryov relates, Okladnikov accompanied him on a trip to the source of the Lena River, climbing a narrow trail up the Primorsky Range to a mountain valley at the 900-metre level where a "few hours of leaping from one moss-covered tussock to another brings you to two unobtrusive ankle-deep brooks", the Bolshaya Lena and the Malaya Lena. Where they join, the river begins.

I found Okladnikov standing outside the institute talking with a group of his students. A big florid-faced man with thin white hair, he greeted me heartily. He would be delighted to talk to me. But first I must see a film.

Clumping along with his stick, he led us through the halls to a cluttered room in which various native garments, a skin drum, weapons and utensils were laid out on chairs and boxes. I knew even before he told me that they were part of a shaman's regalia, although I had not seen anything like them since Chief William Scow of the Kwakiutl people of British Columbia opened his carved cedar chest to show me his hereditary regalia at Alert Bay many years ago.

One of Okladnikov's post-graduate students, a very earnest young woman, had been working among the Mansi in the Khamty-Mansi National Area of Western Siberia. Her film, shown on an old projector with frequent interruptions for rethreading, recorded the life of a small band still clinging to its age-old hunting and fishing existence. Sensing inevitable change, aware that their way of life no longer had the same appeal to the young people, the old shaman had relinquished the regalia symbolic of that way of life.

I realized that for the institute it was a rare and important acquisition.

Upstairs in his office, Okladnikov patiently answered my questions, firm in expressing his belief in what could be proven, cautious in voicing an opinion about what was still in doubt and swift in dismissing what he considered to be the more fanciful speculations of his colleagues.

"I think it has been proven that man crossed into America

around 30,000 years ago—how much longer hasn't been proven yet," he said. "The finds at Old Crow are the proof we have that man was in the Canadian Arctic that long ago."

He was referring to the extensive finds of mammoth, bison, horse and caribou bones worked and altered by men along the Old Crow and Porcupine rivers in the northern Yukon. The bones, washed out by the rivers and redeposited in sediments of more recent age, have been dated as being between 25,000 and 30,000 years old. It is a piece of systematic archeological investigation which owes as much to the laboratory as it does to the field work, for the laboratory proved that the bones had been worked by the same flaking techniques used on stone.

Okladnikov agrees with the majority of his Soviet, Canadian and American colleagues on the routes to America followed by ancient man.

"There are two probable migration routes, one along the south coast of what at that time was the Bering land bridge and the Aleutian Islands, the other across the Bering land bridge, through Alaska to the north coast and then eastward along the coast.

"But," he shook his head, "there are still too many gaps in our knowledge, too many questions still to be answered."

One unanswered question that bothers him is the fluted Clovis point, named for the site in New Mexico where it was first found. "We have found nothing resembling it in Siberia," he said.

I suggested that since in any society innovations on existing techniques must be made through the experiments of an individual or a group, to be adopted generally for their superiority, the Clovis point might be an American innovation.

He gave me a shrewd glance. "Perhaps," he said. "We're still looking. We're still looking for a continuation of the Levalloisian tool tradition in America, although we have evidence of it in Siberia. The most we can say now is that we have found nine common elements in the tool traditions of our Far East and America. I'll give you a copy of my book *On the Alaskan and Aleutian Islands* before you go. You'll find them listed there.

"As to the origins of these first Americans, I think that they came from the region of Lake Baikal. But proving those origins and tracing the routes of the first Americans will require the ful-

lest cooperation of Soviet, Canadian and American archeologists. After all, discovering the origins of the Inuit people was a common achievement of Soviet and American archeologists."

Before I left I had to see the institute's museum, filling four rooms and rapidly overflowing a fifth.

Okladnikov was in a jovial mood as he led me from one display case to another. "That," he said, pointing to a skull, "must be one of my ancestors because it was found near the village on the upper Lena where I was born."

The last display case contained artifacts and other articles donated by foreign visitors. I added to it by presenting him with a three-metre-long oil-paint rubbing that my wife had made of a recently discovered rock carving on Gabriola Island in the Gulf Islands of British Columbia.

From the Institute of History, Philology and Philosophy it is only a short distance to the buildings housing the Siberian Branch of the Soviet Academy of Medical Sciences, but in that distance I covered the 150,000 years between the first people who adapted themselves to the Siberian climate of the ice ages and the scientists who concern themselves with the adaptation and health of the diverse peoples who constitute the 30 million population of Siberia today.

The Siberian branch, which was a filial of the academy until 1980, covers an immense territory. Its jurisdiction runs from the Urals to the Pacific and north to the Arctic islands. Within that jurisdiction, it coordinates all medical and biological science, planning and research, and organizes and directs clinical work in cardiology, children's diseases and other fields.

I had mentioned that I would like to talk to some doctors about their work in the north, but I was not expecting to be greeted by three of Siberia's top medical scientists when I walked into the large softly shaded room with the highly polished furniture typical of such meeting-rooms in the Soviet Union.

Prof Yuri Borodin welcomed me and introduced his colleagues, Prof Yuri Nikitin and Prof Nikolai Deryapa. "Well," he said after we had seated ourselves, "what can we tell you?"

What they told me was that a study in human adaptability to different climates was under way throughout the country, as part of which the Siberian branch was investigating the effect

of northern climatic conditions to ascertain whether some people adapt more readily than others.

"We know, for instance, that people who come from forest zones are better suited than people who come from prairies," said Borodin. "We know that when people from our central and southern republics move to the north they come under physiological and psychological tension, reflected in changes in their blood pressure, for example. We have to determine what regime, what diet, what medicines to recommend to doctors in order to relieve that tension."

"The native peoples have been born for countless generations into this cycle of long winter darkness and long summer daylight. When some one from central Russia has to face the long nights of the northern winter, however, the biorhythm is disturbed." He turned to Deryapa, remarking to me, "He is supervising these studies and has made a number of field trips. He can tell you about it."

"There's a difference between the metabolism of people who come from central Russia and the native peoples indigenous to Siberia," Deryapa explained. "The native people can eat a lot of meat and fat and they won't suffer from sclerosis. They are not prone to hypertension to the same extent as people from central Russia who eat a lot of sugar and carbohydrates. Native people also have different reactions to various medicines."

Our discussion turned to the incidence of tuberculosis among the native peoples, the effect of changing diet and the prevalence of alcoholism, all problems among the Inuit and Native Indian peoples of the Canadian north. What had Soviet doctors learned about tuberculosis among the native peoples?

"Our conclusion is that tuberculosis is not a product of mal-nutrition, but linked rather to susceptibility and isolation," Borodin replied. "The natives live in small settlements and are nomadic, leading an isolated existence. We have established that certain virus diseases which afflict certain peoples can be linked to particular areas. The natives are prone to tuberculosis, although not in its severe forms, and the most effective way of combatting it is by strict examination and early diagnosis."

That raised the question of how doctors reached natives in remote areas in order to examine and treat them.

"The most important thing," said Nikitin, "is the number of doctors available. In the country as a whole we have an average of 38 doctors for every 10,000 people. In the north the average is 50 doctors for every 10,000 people. You can compare that with the figure 70 years ago, before the revolution, of one doctor for every 25,000 people and 350,000 square *versts* in Yakutia, which then had the poorest medical services in all Siberia.

"We make extensive use of helicopters to get the doctors into isolated settlements. Many clinics use helicopters on a regular basis and," he added with a smile, "the natives always ask for them. Our doctors fly thousands and thousands of kilometres every year."

"We have the same problem you have in Canada of the native people abandoning their own well-adapted diet for prepared foods and the same injurious effect on health," Borodin replied when I asked him to what extent exploration and industrial development in the north was altering the way of life.

"How do you overcome it?" I asked.

"We work out special diets," Borodin said.

"But do the native people follow those diets?"

"Well, most of them."

Borodin pointed out that the diets were based on extensive research throughout the entire field of food production. At Norilsk, the big Arctic nickel and copper mining centre on the Pyasina River, the Siberian Branch of the Academy of Medical Sciences conducts joint research with the Siberian Branch of the Academy of Agricultural Sciences into the adaptation of plants to various northern conditions, their uses in diet and their benefits to health.

"We're making a special study of Siberian herbs, some of which the native peoples have been using for centuries, because we believe there is a lot to be learned."

That prompted me to ask him about *oblepikha*. At breakfast in Novosibirsk that morning, at a restaurant facing Lenin Square, I noticed that people at surrounding tables were drinking an orange-brown juice. It was the first time I had seen it and I had to try it. The taste was pleasant, neither sweet nor tart, and I am sure that if I had been able to find the juice again I

I would have become an addict. Idly I wondered why it had not been cultivated for commercial use on a larger scale.

My curiosity was heightened when, stopping to admire the luxuriant garden of an academician's villa in Akademgorodok, I spotted an *oblepikha* bush. The berries resisted my pull and the bush had thorns, but the taste was delicious.

Nikitin enlightened me about *oblepikha*.

"You've tasted our *oblepikha* juice, have you? It's a good drink, rich in Vitamin A. In fact, *oblepikha* has quite a number of medicinal properties, but we prize it most for its oil which is used in treating ulcers and burns. But it's only produced at one plant in Biisk.

"The bush you saw must have been transplanted from the wild if the berries were hard to pick. Our agricultural researchers have produced several new varieties—the bushes are thornless, the berries are tastier and they're easier to pick."

The disease of alcoholism is perhaps the most difficult of all to eradicate because, in Borodin's words, "the roots are both psychological and physiological". The days are long past when epidemics of smallpox and other diseases introduced by the Russians, compounded by frequent famines, reduced the once numerically strong native peoples from thousands to hundreds and doomed others to extinction. Yet, Borodin observed, "alcoholism lingers as the curse placed on the native peoples by the Moscow merchants who plied them with liquor in order to get their furs". It persists too as a problem on construction sites and in worker settlements where the psychological factors of distance and darkness create stress.

"We have made a lot of progress, but we can't say that the problem has been overcome," Borodin said frankly. "Drinking in the north must always be strictly controlled. When I was in the field I used to get everybody in the camp together for a social drink once a week because I found it relieved tensions that inevitably arise when people are compelled to live and work closely.

"Now we have devised a new approach to work in the north, although it can only be regarded as a temporary measure, not a permanent solution. One crew is flown in and works for two weeks, then it is flown out again and replaced by another team.

It overcomes many problems because workers know how long they will be at the site and they can adjust far more easily."

Every so often I pick up a Canadian or American paper to read some purported expert on Soviet affairs subtly intruding racism into his discourse by discerning a vague threat to the Soviet Union's future in the higher population growth of its Asian peoples as compared to its European peoples. The fact that from the inception of the Soviet Union as a multi-national state, the government proclaimed the full and equal status of its peoples and has striven consistently to make this the socialist reality in itself is sufficient to expose this as palpable nonsense.

If more were needed, Borodin's parting words to me provided it.

"The Siberian population can be divided into three groups—the native peoples who were here long before the Russians came, those we call the Old Siberians who are descended from the early settlers, and the New Siberians who have come in recent times. The best adapted to the north are the native peoples, among whom the Yakuts are by far the largest group. Our main purpose is to ensure the health and population growth of the native peoples in the territory they have occupied for centuries."

CHAPTER V

Milk and Meat

Going out into the hotel lobby, I found Vasily Lezhnin waiting for me. I liked this kindly and unassuming man, a veteran who served on the Byelorussian front during the war and fought in the Soviet armies across Poland and into Berlin. Whatever time we set to meet in the morning, he was always punctual. Sometimes he would accompany me and sometimes he would offer his apology and go off for a few hours to attend to pressing business awaiting him as general manager of Vneshtorgizdat, Siberian branch, publishers of the technical information, translated into 12 languages, that accompanies all exports from Siberia.

I knew he had accepted responsibility for arranging my itinerary at the last minute, filling in for some one else, and I felt I was imposing on him whenever I asked for anything. Suddenly he had to rearrange all his work to escort me around, caught between the demands of my schedule and the pressures of his own work. He must have spent a lot of time on the phone making arrangements in which there was never a hitch.

"Today," he announced, "we are going to the Siberian Branch of the Academy of Agricultural Sciences of the USSR and tomorrow we are going to a collective farm."

"Good," I replied, "will you be able to come?"

"Yes, farming is something I know about."

Then I remembered. In taking me around the museum earlier, he had pointed to a primitive iron plow in an exhibit, commenting, "I used one of those when I was a boy."

On our way to the Branch I asked him about it.

"I was raised on a collective farm, a kolkhoz as we call it, about 45 kilometres from here," he said. "Now it's a state farm. In those days we didn't have mechanized equipment and we worked with whatever implements we had. My father, who was

killed in the war, had been chairman of the kolkhoz and worked me harder than anyone else just because I was his son. He had very little education—he only went to school for three years—but he was a good farmer. My mother had no education at all and she could neither read nor write.”

The times he was telling me about were not some remote period, not even in the last century, but within the last 50 years. Yet here, as we drove past experimental plots and gardens to the imposing main building of the Siberian Branch of the Academy of Agricultural Sciences, was a big institution, how big I had yet to learn, devoted solely to agriculture in Siberia.

My time span was too long. It has all been done in 10 years.

“The branch was established in 1970,” Yuri Novoselov, the tall greying man who is a deputy chairman, informed me. “Now it has two filials, 23 regional institutes, 73 experimental stations, 63 experimental farms and a small kolkhoz where experimental work is tested on a larger scale. We have 470,000 hectares of land producing 100,000 centners of crops—a centner is equivalent to 100 kilograms. Those crops are worth 25 million roubles annually.”

“And how many people are employed in all these institutes and farms?” I asked.

“About 7,000,” he replied. “That includes 3,000 scientists.”

Statistics generally have little meaning for those who are not part of the process of producing them. A collective-farm worker will point with satisfaction to the figures that show his farm has exceeded its quota and the statistics will be incorporated in the total of the country’s production and reflected in its living standards. Outside the living process, the statistics will be studied by economists and planners—and combed by anti-Soviet analysts seeking figures taken out of context to give a semblance of authenticity to their dire predictions about the Soviet economy. The alleged failure of Siberian agriculture is a recurring topic.

The statistics Novoselov gave me cannot easily be distorted, for they represent an undeniable achievement. Since the revolution the area in agriculture has been quadrupled and the crops taken from them tripled, with an average yield of 1.3 tons to the hectare.

Novoselov was frank in discussing the problems of Siberian agriculture with me.

"We have 32 million hectares of land in agriculture in Siberia," he said. "You have 44 million in Canada. Conditions in our two countries are similar and that's why our scientists go to Canada to study how your scientists approach problems we have here. But there's one important difference. Canada has more rain and it's better distributed. Drought years in Canada are relatively rare. Dry years in Siberia are the norm. That's why conditions for agriculture in Siberia are more difficult and our crop yields are lower."

"We grow wheat, winter rye, barley, oats and buckwheat. We grow maize, beets and peas, all for fodder. We grow potatoes. Those are our main crops."

"A major part of our wheat crop comes from Novosibirsk 67, the new spring strain developed by our scientists which gives a larger yield than other varieties and has superior flour and baking properties. About two million hectares are sown to Novosibirsk 67 and the yield is between five and seven centners to the hectare higher than the yield of other spring varieties. Altogether, about 90 percent of our wheat lands are sown to spring varieties."

"We produce more wheat and more potatoes than we consume, but we still don't produce enough milk and meat for our needs."

"I'm sure you know about our reindeer herds. Most Canadians and Americans know about them because reindeer have been introduced into the Canadian north and Alaska. Yes, we raise reindeer on a tremendous scale, 2.3 million in domesticated herds and about another million on ranges in the wild. We're also experimenting at Norilsk with the musk-oxen we got from Canada. The herd has grown to 75 animals and it's thriving. Unfortunately, all this tends to obscure what we have accomplished in raising other livestock."

"We raise a lot of beef cattle. We raise sheep, around a quarter of the country's total. We raise pigs as well as poultry—turkeys, chickens, ducks, geese—on an industrial basis. At Omsk we have one of our most successful industrial pig farms. At Tyumen we have our largest egg and broiler industrial farms."

At Usolsk we have another big industrial farm producing eggs, duck meat and pork products. And still we have to produce more.

"Our dairy cattle include Hereford, Holstein and Holstein cross, as well as two breeds derived from native strains, Kazakh and Kalmyk. The native strains had good qualities but the milk yield was small. By crossbreeding we've tripled the yield while preserving the good qualities.

"We still have some way to go in bringing our milk production on state and collective farms up to the level of our experimental farms. On these we get a production of between 5,000 and 6,000 kilograms a year, but our average for general farm production is 2,300 kilograms. That's below European levels."

I knew that dairy cattle were kept on farms at Norilsk and in northern Yakutia and I asked him about it. He nodded. "Yes, at Norilsk we're now supplying about 3,500 tons of milk a year."

Then I told him about Dr R. D. Livingstone, for many years chief medical officer in the Canadian Arctic, and his Polar Sea Dairy Farm at Aklavik in the Mackenzie delta.

The idea of a dairy farm in the Arctic took shape when Livingstone was transferred to Aklavik in 1938. He had been raised on a farm and to his experienced eye the stretches of native grasses covering cleared land around Aklavik offered sufficient grazing for a cow. He brought in a cow, by rail to Waterways, Alberta, and down the Mackenzie River by boat, and later a yearling bull from Fort Simpson, some 1,100 kilometres to the south and the farthest north settlement at which dairy cattle were kept.

Unlike the Yakut barns of short logs plastered with clay, Livingstone's barn was built of sawn lumber but similarly sealed against the cold with plaster inside and out. At first he fed his cattle on hay cut for winter feed, but after he received a grant of land from the government he planted it with barley, oats and rye—barley sown on June 15 would be ripe by August 15 and oats and rye a few days later—and his unrealized ambition was to obtain some of the Soviet varieties developed for northern planting.

By the time he retired in 1944, an unrecognized pioneer, he had built up his dairy herd to 12 head and was supplying milk

to the hospital and the school. Native children who had never tasted milk before were getting it regularly and he was keeping careful health records of those who received it and those who did not. But the farm did not survive him because there was no one to take it over when he left.

Novoselov listened attentively. "From our viewpoint, the important thing is to produce on the spot whatever will spoil easily," he observed. "In cold areas like Nizhnevartovsk, vegetables can be grown in hothouses, but there we can use thermal heating. To be efficient, hothouse production or any similar undertaking must be concentrated in selected areas."

In the program to make Siberia self-sufficient in agricultural production, the branch is expanding. Already it is the size of a major Canadian university campus, complete with its own specialized library of one million books. The plan for expansion, of which I saw both the architect's model and the completed first housing phase, calls for three rings of residences to house 12,000 persons.

"We don't intend to increase the amount of land in agriculture to become self-sustaining. Rather we will concentrate on increasing the yield from the land we already have in production," Novoselov declared. "To do that requires more research, more experimentation, more new varieties and more efficient methods. It can be done."

I got an idea of how it is being done, literally at grass-roots level, the next day when Vasily took me to the Bolshevik kolkhoz, 73 kilometres southwest of Novosibirsk.

It was a typical Siberian early fall day, chill in the morning and gathering warmth as the sun dispersed the streamers of cloud in a pale blue sky. We left the new industrial districts behind and emerged into flat open country, frequently broken by stretches of trees, and presently we were looking out across the expanse of the Ob Sea past wooded promontories that formerly were hills to the distant merging of water and sky. Along the road, flocks of crows and the occasional black and white magpie flapped disdainfully to the side as we approached.

Verkh-Irmen, where 2,000 members of the collective farm live, is a pleasant village and judging by the number of cars I saw around the houses, a prosperous one. Beyond the stream

that borders the village, on the stretch approaching the farm's centre, a dirt road runs parallel to the highway and there, on their personal plots between the road and a windbreak of trees, farm workers were digging their potatoes. It was a scene I had seen many times elsewhere. This, however, was different. On the dirt road their cars were parked beside the plots, trunk lids open, to haul the potatoes away.

The farm's administration building, two storeys of white stone with a frieze running above its recessed entrance, might have been an enterprise in a Canadian industrial park, except for the bust of Lenin standing amid the petunias and nasturtiums. Cars were parked to one side and a motorcycle was propped against a low wall, its front wheel draped with flowers. Beside the entrance a big blue-and-white board recorded the farm's rising production over the past five years.

"It's been a good year for grain," said Yuri Bugakov, the farm's chairman, when I asked him about it. "Already we've harvested 20,000 tons and only half the crop is in." His companion, Anatoly Rusakov, secretary of the kolkhoz Party Bureau, nodded in agreement.

"What about frost?" I asked.

"Sometimes we get the first frost in late August or September. Usually it comes around the beginning of October. This year, however, we had our first light frost on August 13."

I asked him how many frost-free days Novosibirsk Region had as compared to Tyumen.

"We get 169 frost-free days and 123 days with snow," he replied. "Tyumen has 123 frost-free days and 164 days with snow. We're both better off than Yakutsk where they only get 95 frost-free days and 206 days with snow. That's why we can grow good maize crops, but we can't grow sweet corn. The season is too short."

As Bugakov took me around to show the farm's own school, which has some 600 students up to grade 10, its day care centre, 75-bed hospital and cultural centre, I became aware that this in fact was a self-contained farm town and that he, as chairman, was its mayor.

A vigorous man, more at ease in the field than in his office, Bugakov pointed out that state and collective farms were large

enterprises, many of them with their own processing and packing plants.

We walked past a row of neat white two-storey houses, each with its own sheltered porch and its garden enclosed by a picket fence.

"We have some apartment blocks which were built earlier," he explained, "but we're getting away from that. Now we're building individual houses for families. It's what people in the country have been used to for generations."

He stopped at the door of a big sloping-roofed building faced with cement blocks. "This is one of our dairy barns," he said. "We have 1,700 dairy cattle, a Siberian breed we call Chernopyostroyaya, a black-and-white cross, and we plan to get some Holstein cattle to cross with it. That will give us a cross which will be one quarter Holstein and three quarters black-and-white. Our production from one cow today is 3,800 kilograms a year—6,800 tons a year from the herd."

With that he led me into the barn, as clean and modern as any I have seen and fully equipped for mechanical feeding and waste removal.

He pushed open a door near the entrance. It led into a vestibule beyond which was another door. "Here's something you won't see in a mild climate," he remarked.

The second door led to a massage room for the women who work in the barn, each milking 120 cows, a clinic, a small cafeteria and a records office. "This way," he added, "the workers don't have to go outside the building at all during working hours in the winter."

The farm also has some 3,300 beef cattle which produce 1,000 tons of meat a year. The cattle are grass fed, polished with grain and at 530 kilograms, the weight of a 16-month-old bull, they are shipped to a packing plant at Novosibirsk.

I remarked to Bugakov that the farm must have some sort of veterinary service to look after such a herd.

"We have eight veterinarians," he replied casually, "and another eight technicians who look after the diet and the health of the cattle."

Members of the collective farm are guaranteed a minimum of 174 to 180 roubles a month, supplemented in good years when

the plan has been fulfilled or exceeded by an additional rouble for every rouble earned. "But that doesn't mean necessarily that earnings are doubled," he added.

Men work 270 days a year and they get 90 days' holidays. Women work 240 days a year with 120 days' holidays. All get at least one day a week off. Again he hastened to explain: "During the harvesting season, of course, that isn't always possible. Sometimes we need every hand we've got. But the extra time worked can be taken off later."

Then we climbed into his car, a big black Volga sedan incredibly durable in its ability to negotiate rutted roads, potholes, ploughed fields and sand, for what he said would be a personally guided tour.

It was. As he drove through the fields he gave me some of the farm's own statistics—18,000 hectares of land, 9,000 of them under grain, including 2,000 hectares of flax from which the farm processes the oil in its own plant to provide work between growing seasons; 50 combines for harvesting and 40 trucks for general farm work.

We looked at the irrigation system elevated above the fields on its supports, an ingenious network allowing water to be given to any and all areas. We watched the combines at work along the edges of a vast stand of maize seemingly extending to the horizon.

"That's our milk and meat," he commented. "We get 50 tons to the hectare."

We examined the heads of wheat and we inspected the grain cleaning operation. And at the end of the tour when it was time to turn back he said almost apologetically, "You still haven't seen more than 30 percent of our land."

"It's quite an enterprise," I said.

"I'm glad you think so," he replied, "because we farm here much the way you do in Canada. But we had some Americans here a few years ago and they weren't impressed. They told us our crops were poor and our methods inefficient."

We returned to a meal that was more like a harvest banquet. What Bugakov called lunch offered just about everything the farm produced, including bread freshly baked from the farm's own flour and a dessert of *oblepikha* berries and red whortle-

berries, all eaten to the accompaniment of the inevitable succession of toasts.

Reluctantly after such hospitality we got into the car to return to Novosibirsk. And glancing back as we left I saw Bugakov and Rusakov going off to change into their work clothes. As Bugakov had told me in describing their working conditions, every hand was needed at harvest time.

Back in the city, we stopped at a farmers' market, its stalls alive with gladioli, dahlias and chrysanthemums and heaped with apples, pears and plums, melons and grapes, tomatoes, cucumbers and peppers. Lyalya wanted to get some cedar nuts.

"Cedar nuts," I exclaimed. "What on earth are cedar nuts?"

Cedar nuts, I learned, are produced by a Siberian cedar which is not a true cedar. Siberians chew them much as people elsewhere in the country chew sunflower seeds. They can get them in the forests for the taking. Lyalya got hers in the market, a big bag of them, and they cost her 10 roubles.

"Try one," she urged. I did and soon decided it was a taste that had to be cultivated.

"They're very rich in oil," Vasily assured me. "It's considered to be equal to the best olive oil."

Dipping into her bag, Lyalya almost looked happy.

The beginnings of agriculture are not to be found around the new city of Novosibirsk, which still has to celebrate its centenary, but in the early settlements along the Yenisei and Lena valleys and around the old city of Irkutsk, where we arrived after another delayed flight in what was becoming a familiar pattern.

Like the history of most Canadian cities west of Winnipeg, the history of Novosibirsk is only a generation removed from living memory. Irkutsk traces its history back to 1652 when it was established as a wintering station on an island near the mouth of the Irkut River and its foundation nine years later as an *ostrog* built where now the city stretches along the Angara River. By that time there were already peasant households along the Yenisei and the Lena growing rye, wheat, oats and barley.

Strategically situated at the southwestern end of Lake Baikal astride the trade routes between China and Central Asia.

Irkutsk grew rapidly to become the administrative and trading centre of Eastern Siberia.

Martin Sauer, travelling as geographer with Capt Joseph Billings, who served with Capt James Cook on his last voyage and later joined the Russian navy, recorded this impression of Irkutsk when he and Billings visited in on a mission for Catherine the Great in 1786:

"The shops are in the heart of the city, an elegant square pile of brick building under piazzas which support warehouses. The butchers' shops are in the eastern extremity... Near this is the fish-market, also a bazaar or rynok for vegetables, corn, bread, butter, flour, pedlary and wooden ware. The latter is a place of resort for the Burati, who hawk about sables, martens, otter and other furs..."

"The merchants are numerous and affluent; and a considerable trade is carried on with the Chinese..."

"Here the assortments of furs are made, which are brought from America, and the northern parts of the empire..."

Sauer estimated that Irkutsk at that time had a population of 20,000, reporting that the town consisted of "2,500 houses, chiefly of wood, 12 stone churches, a cathedral and two monasteries; beside which, there are several public buildings, an hospital, a seminary for the study of divinity, a public school, a library and collection of curiosities; also a theatre..."

John Ledyard, who had also sailed with Cook and Billings on the voyage that touched at Kamchatka and met Billings again at Yakutsk, noted in his journal that A. M. Karamyshev, the Bank director at Irkutsk, gave him an apple from a tree in his garden no larger than a full-sized pea. "It is the true and real apple," he wrote, "and their Naturalists distinguish it by the name of *Pyrus Ranata*. These are the only apples in Siberia, those found only in the environs of Irkutsk..."

Of all the commodities that passed through Irkutsk in trade, the most unlikely was the "secret root of rhubarb," as it became referred to in tsarist edicts. Dried and rasped, the root of the plant now so widely grown in its garden varieties, was a rare and costly medicine over which the tsarist government quickly established a monopoly.

The Russians learned soon after their arrival in Eastern Sibe-

ria that rhubarb grew near Lake Kokonor and that its roots were traded across the Chinese border along the caravan routes to Central Asia. In 1657 the tsarist government issued an edict forbidding private persons to engage in the rhubarb trade under pain of death. Later it sold the rights to the Siberian rhubarb monopoly to a succession of individual merchants, but when the lucrative profits from the trade became apparent it reclaimed the monopoly for itself.

Old records show that in 1704 a man named Larion Senyavin was sent to Turfan, in modern Sinkiang, and other Chinese cities to buy 300 poods of rhubarb for the state. He was given 1,000 roubles to buy Russian leather for use in trade and at Irkutsk he got fur pelts and money for his mission. He himself was paid a salary, including 200 pails of plain wine a year, "so that he, Larion, seeing His Great Majesty's grace toward him, will make more profit in the purchase of rhubarb as compared to former times". Again the death penalty was decreed for anyone else engaging in the trade.

Agriculture in Siberia, and not only agriculture but most of the arts and sciences were greatly influenced by the Decembrists who were exiled there after the failure of their attempt to overthrow Tsar Nicholas I in 1825. Intellectuals influenced by the ideas of the French Revolution and the writings of the Russian revolutionary thinker, Alexander Radishchev, and many of them drawn from the nobility, they had organized into secret political societies convinced of the need to overthrow the tsarist autocracy and abolish serfdom in order to lift the country out of its backwardness. For their part in what has been described as an attempt to undertake a revolution in the name of the people without the people's participation, five leaders of the armed uprising were hanged—Pavel Pestel, Sergei Muravyov-Apostol, Mikhail Bestuzhev-Ryumin, Pyotr Kakhovsky and Kondraty Ryleyev. Other Decembrists were sent to penal servitude and exile in Siberia.

Radishchev, himself exiled to Ilimsk in Eastern Siberia in 1791, summarized the deficiencies of its agriculture in a few words:

"The agriculture of this country is vast, but I would not say it is in a flourishing condition.

"Excluding the years of dearth, the land produces well, but

the soil is quite unfruitful. Fertilizers are hardly known, but the fields would have great need of them. The immensity of the land allows one to pass up improving it and always to cultivate virgin lands elsewhere...

"In many places the peasant lives in abundance; the old inhabitants are often wealthy from raising grain and cattle, but lack money from the absence of markets; the colonists are for the most part poor."

Many of those exiled to Siberia were sent to Chita, now a city on the Trans-Siberian Railway some 650 kilometres directly east of Irkutsk, where they constituted what came to be called the "Academy of Chita" because of their work in agriculture, education and medicine.

Baron Rosen was among those sent to Chita. There, as he noted in his memoirs, he found the Buryats engaged in farming, "with meadows and fields as well irrigated as those of the Milanese".

Amazed at the rapid growth, he reported that "both corn and vegetables ripen within five weeks of the frosts' ending, that is, between mid-June and late July. Many varieties of vegetables, however, were then quite unknown in those parts. One of our comrades was the first to introduce the cultivation of cucumbers in the open, and of melons in hotbeds..."

Rosen himself directed the Buryats in the cultivation of such grains as buckwheat, rye and barley.

It was to this circle of brilliant intellectuals giving lectures among themselves in chemistry, mathematics, Russian history and literature, "to enliven the long winter nights", as Rosen described it, that Alexander Pushkin, the great Russian poet, sent this poem:

*Deep in the Siberian mine,
Keep your patience proud;
The bitter toil shall not be lost,
The rebel thought unbowed.*

*The sister of misfortune, Hope,
In the under-darkness dumb
Speaks joyfully courage to your heart:
The day desired shall come.*

*Friendship and love shall come to you,
Come through the gloomy doors,
Even as round your galley-beds
My free voice pours.*

*The heavy ringing irons shall fall,
The walls shall crumble at a word
And freedom greet you at the gates;
And brothers shall revenge you all.*

My last visitor at Novosibirsk was Vasily Pukhnachyov, a poet and translator, who came to the hotel to say goodbye just as we were leaving. A slight little man, restless and voluble, he wore his peace medal as a member of the Soviet Peace Committee as proudly as he wore his war service ribbons.

"During the war we were allies against the enemies who had destroyed the peace," he declared. "In the fight for peace all of us who want peace must be allies against those who would destroy us all." It was a simple statement conveying a profound thought.

Pukhnachyov has brought me recordings of his poems set to music and copies of his books, one of which, *Tales of Old Tym*, has been translated into six languages and gone into 35 editions.

Earlier in the week he had accompanied us to the State Theatre of Opera and Ballet to see a performance of Tolstoy's *Anna Karenina* as a ballet and he insisted on toasting us in champagne during the intermission.

When he was not offering toasts, he was regaling us with stories about the native peoples and his experiences among them in recording their legends.

Chuckling, he told me about one old hunter he knew years ago. When he was given a telescope the old man put it carefully to one eye, then to the other. Reversing the ends, he repeated his actions. He was delighted. "Now I shall know what to do," he said. "When the deer are far away I shall put this end to my eye and they will come close. And when my enemies come close I shall put this other end to my eye and they will go far away."

My first visitor at Irkutsk was Vladimir Smirnov, a young poet and writer who publishes his work under the name Skif. He had grown a beard and for a moment I did not recognize him. But as soon as he told me his name I remembered him. In

1974 when I was with an international writers' group invited by the Union of Soviet Writers to tour the country in which Pushkin lived and worked, he had flown into Mikhailovskoye for what was a memorable event. I should have thought that every home in the Soviet Union had at least one copy of Pushkin's works. Yet at Mikhailovskoye, where some 10,000 people had gathered in an open park fringed by woods for a festival commemorating Pushkin, long tables were piled high with books by and about him and the books were being sold almost as fast as they could be placed on the tables. At the end of that day my wrist had ached from autographing books held out by an unending line of young people eager for signatures.

"I translated one of your poems," he said, "and I've brought a copy along for you."

"How did you do that?" I asked. I knew he had very little English.

"I got a literal Russian translation and worked from that."

Such perseverance deserved recognition. I gave him copies of my most recent books of poetry and he promptly exacted a promise from Lyalya to make literal translations for him.

He told me that he spent a lot of time at the Lake Baikal country home of his brother-in-law, the novelist Valentin Rasputin, where his favorite pastime in the fall is berry-picking.

"I don't like hunting or fishing," he said, "But I really enjoy berry-picking. We have every kind of berry here—*oblepikha*, red whortleberry, blackberry, blueberry and cranberry. Honeysuckle berries are the first to ripen and I sometimes find it hard to convince people that they make very good jam."

"Berry-picking is absorbing, but it allows you to think where there is nothing to disturb you. Chernyshevsky found that gathering mushrooms did the same thing for him when he was in exile at Vilyuisk."

The sense of being part of the unspoiled beauty of its setting is very strong in Irkutsk. Downstream from Lake Baikal on the Angara, the only river flowing out of the lake, it is a green city with its tree-lined streets, its squares and gardens massed with roses, marigolds and salvia. Although its population is half that of Novosibirsk, it shares the same influence of a great river over its destiny, shaping its expansion along both banks. And, as at

Novosibirsk, the river is accessible. Below the stone embankment across from the hotel, at the edge of the wide grass-covered river flats, people were fishing and small pleasure-boats darted past the big white river boats in the mainstream.

The administrative seat of the largest region in Eastern Siberia, the city also shares with Novosibirsk the claim to being both an academic and industrial centre. In the Irkutsk filial of the Siberian Branch of the USSR Academy of Sciences one quarter of research workers are geologists whose work is reflected in the growing importance of the Irkutsk Region's mineral resources.

"We have a new iron town, Zheleznogorsk-Ilimsky, under construction about 800 kilometres from Irkutsk," Innokenty Melnikov, deputy chairman of the Irkutsk regional executive committee, informed me when I met him. "It is an open-cast mining operation and the concentrates go to metallurgical plants in the Kuzbas. And the old town of Usolye-Sibirskoye where salt was mined in tsarist days because of its exceptional quality—Obo-lensky, one of the Decembrists, was sent to the mines there—is now a modern chemical complex."

It is as a source of electric power generated by three great dams, at Irkutsk, Bratsk and Ust-Ilimsk, however, that the Irkutsk Region has become the centre for two power-consuming industries, aluminum and cellulose. Between them the dams generate 50 billion kilowatt-hours of electricity a year to supply the new aluminum town of Shelekhov and the new wood-processing complexes at Bratsk, the largest in the world, and Ust-Ilimsk. The effect has been to transform a sparsely populated area where people followed the traditional occupations of farming, wood-cutting and trapping into a new industrial base, although, as I was to discover, beyond the new centres people still follow the time-honored way of life.

Amid all the changes, Irkutsk preserves the continuity of its history. It is most immediately apparent in the remaining old houses, a few of them small mansions and architectural masterpieces of their period with their intricately carved facings and sheathed cupolas. These were the houses of the merchants, the old wealth amassed by the few. The new wealth is in the white gold of electricity, the green gold of wood, transformed into the rising quality of life in which all share.

CHAPTER VI

River Diversion: The Great Debate

For the past quarter century Soviet scientists have been studying schemes for diverting and redistributing Siberia's water resources, debating their advantages and disadvantages and weighing their possible consequences. Not that the idea of using the waters of the Ob and Yenisei rivers to irrigate the desert lands of Central Asia is new. As far back as the end of the nineteenth century, Demyanenko, a Russian engineer, was advancing his proposal to divert part of their waters southward. Then it was no more than a daring concept. Now it is technologically feasible and within the realm of possibility, although any of the schemes proposed will take decades to complete and cost billions of roubles.

The very magnitude of the schemes captures the imagination. They range from the diversion of the Ob and Yenisei waters, for which a number of alternative proposals have been made, to the damming of the Bering Strait. And all of them hold possible consequences to terrain and climate whose effect would be felt far beyond the Soviet Union.

The Ob, like the Yenisei and the Lena, flows into the Arctic following the natural slope of the continent. One scheme for diverting its waters calls for construction of a series of dams across the valleys of the Ob and its tributary, the Irtysh. Once the reservoir behind the dams topped the Turgai watershed, the river would reverse its flow. This scheme, based on the concept of the diversion being made from water reservoirs in the central areas of Western Siberia, proposes the use of locks and pumps where needed to lift the water to required heights.

Under a second scheme, a huge reservoir would be formed behind a dam in the northern area of Western Siberia in the lower reaches of the Ob near Salekhard. The waters would be

directed into the basin of the Kama or Volga to follow the natural course southward until they reached canals to carry them to the Ural River and the parched lands of Kazakhstan.

A third scheme proposes the creation of an artificial river starting in the Altai and Sayan mountains and flowing through existing canals across the Turgai watershed to Kazakhstan, a scheme, however, that would be limited by the capacity of the canals.

The scheme for closing the Bering Strait with an 85-kilometre dam is the boldest of all in its scope. In effect, it would reestablish in artificial form the old Bering land bridge of the ice ages—but with the difference that Arctic water would be pumped through the dam into the Pacific at the rate of 140,000 cubic metres a year.

The arguments for all these schemes are persuasive. Given the water, Kazakhstan, Uzbekistan, Turkmenia and Kirghizia can expand their agricultural lands, triple their grain harvests and contribute to Soviet food production fruit and vegetable crops that cannot be grown farther north. Large areas of Western Siberia can be drained and converted to agricultural land. The level of the Caspian Sea, which has been falling for the past two decades, can be raised and the future of its fisheries assured. The Aral Sea, which is steadily retreating, can be saved.

By damming the Bering Strait and pumping the Arctic waters into the Pacific, a scheme first proposed some 20 years ago by Pyotr Borisov, a Soviet engineer, the warmer waters of the Gulf Stream sweeping eastward across the Atlantic and around the northwestern coast of Europe would spread through the Arctic. In the wake of the melting ice, the climate of northern Europe and Asia would warm up, the northern sea route would be opened to year-round navigation and Arctic regions would be released from bonds that restrict their development.

The arguments against these schemes are equally strong. Over the ages natural forces have eroded mountains, raised and lowered sea coasts, altered the courses of rivers, changed climatic conditions, converted grasslands into deserts and deserts into grasslands again. What will be the effect of human intervention in the process, in the north from which the water is to be taken and in the south to which it is to be brought?

If the huge volume of water now locked in the Arctic ice is

melted, how will it change ocean levels and to what extent will it disrupt seaports and flood lands now at sea level? How will it effect rainfall patterns, vegetation, wildlife?

Conversely, under another proposed scheme to dam the Bering Strait in order to block the southward flow of Arctic waters into the Pacific and so warm up the Kamchatka Peninsula, what would be the effect on the fisheries of the North Pacific, on the salmon runs to Kamchatka and Sakhalin Island, Alaska and British Columbia, which have their mid-ocean rearing grounds where Arctic and Pacific waters commingle?

The questions raised by the Bering Strait project, if ever it is undertaken, are so far-reaching that the cooperation of the entire international community, and primarily the United States and Canada, would be essential.

The river diversion projects are within the Soviet Union's own boundaries, but their effect too can be far-reaching.

The Ob and the Yenisei are two of the world's greatest rivers, discharging their fresh and relatively warmer waters into the Arctic Ocean. What would be the effect of their diminished flow on the ice of the Arctic Ocean, which many climatologists believe to be the key to the pattern of glacials and interglacials over the past million years? Would ice formation in the Arctic Ocean increase once the flow of fresh water was lessened or would it decrease because the ocean waters became saltier? Either way, how would this influence the climate of Europe and Asia? What would the environmental consequences be, the effect on wildlife, birds, fish? Only one question can be answered with certainty. If ice formation increased, it would adversely affect the northern sea route.

Even assuming that eventually one or another project to divert water from the Ob is undertaken, the question remains whether the water taken will be adequate for the needs of the Central Asian republics without drawing on the Yenisei waters too.

One alternative scheme, in fact, proposes construction of a canal to take water from the Yenisei to compensate for water lost by the Ob. Under this scheme a canal would be built on the west bank of the Ob, paralleling the river but at some distance from it, to gather water from a system of small hydro-

technical installations taking their water from the Ob and its tributaries. Supplied by these installations, the canal would carry the water southward.

Some scientists have voiced their concern that the creation of deep reservoirs in the north would preclude the complete thawing of their frozen mass in the short summer, initiating climatic changes in Western Siberia. Others are concerned about the effect of the water on the arid lands of Central Asia, questioning the long-term consequences to soil that can become saline and useless under an excess of water.

The questions are many and before any decisions are made the answers will have to come from the researchers of the various institutes now studying them and coordinating their work through the Scientific Council on Redistribution of Water Resources of Siberia.

Such schemes are not new to Canadians, who have a particular interest in them because of similar proposals made from time to time by interests in the United States. Canada has one seventh of the world's fresh water in its rivers and lakes. Some U.S. states, California in particular, already have a water shortage. And as the water shortage becomes more severe, U.S. interests look northward with a covetous eye to Canada's abundant water supplies.

There is a vast difference, however, between the Soviet Union seeking to solve its water problems within its own boundaries in the interests of the country as a whole, and the U.S., which already holds a commanding position in the Canadian economy, warping its development and infringing its political independence, seeking to solve its water problems at Canada's expense.

One such plan was unveiled with great publicity in 1965. Entitled the North American Water and Power Alliance and popularly called the Parsons Plan after the consulting firm which prepared it, the plan proposed a network of giant reservoirs to carry water from the basins of the upper Yukon, Liard and Mackenzie rivers as far south as the Rio Grande valley in Texas and east into Nebraska and Kansas, using portions of the Missouri, Snake, Green, Colorado and Rio Grande rivers. A giant lake, 800 kilometres long, stretching from Prince George to Libby,

Montana, would have been formed in British Columbia's Rocky Mountain trench. Between 70 and 80 percent of the water was to have come from Canadian sources. The cost, estimated then at one billion dollars, would be at least four times that amount today.

The plan evoked fierce political debate in Canada. Reporting to the House of Commons, Prime Minister Lester B. Pearson acknowledged that the U.S. was "very anxious to work out arrangements by which some of our water resources are moved down south", but he warned that Canada must be careful "not to alienate this great resource without taking care of our own needs". Art Laing, as Minister of Northern Affairs, contended that the U. S. could solve its problems by cleaning up its own polluted rivers and lakes. General A. G. L. McNaughton, who commanded the Canadian Corps during the Second World War, declared that "the suggestion of splitting a resource owned entirely in Canada smacks more of plunder than cooperative development".

What the debate did reveal was that the water shortage in the Canadian prairie provinces, already a problem in dry years, was likely to become acute by the year 2000.

Now another plan is being promoted through the World Futurist Society in Washington whose directors are associated with some of the biggest U. S. corporations. This plan proposes the creation of a huge freshwater lake in James Bay at the southern end of Hudson Bay, which would be enclosed by a dike, and channelling the water through the Great Lakes into the U. S. Thomas Kierans, director of the Alexander Graham Bell Institute at Cape Breton College, Nova Scotia, and author of the plan, notes that "political sensitivities have hindered the development of a truly continental concept that would fully utilize all of the major water management potential of North America", but he proposes the holding of U. S.-Canadian seminars and the formation of institutional corporations to conduct studies as the first steps in promoting the plan.

With the U. S. reaching out for Canada's water, with acid rain, largely from U. S. industry, killing life in the lakes of Ontario and Quebec and Canadians generally becoming alarmed over the deterioration of their environment, I had good reason

to discuss with Soviet scientists and administrators what measures to protect the environment they were taking in the industrial development of Siberia.

As Canadian studies have shown, acid rain, the product of sulphur dioxide, nitric oxides and other particles mixing with oxygen and water vapor in the atmosphere and falling as rain or snow, is destructive to fish and vegetation. In Ontario lakes freshwater shrimp, a prime source of food for trout, has been wiped out. In Nova Scotia rivers salmon runs are being depleted. Leaf damage is being caused to beet, carrot, radish and broccoli crops. Forest growth is being retarded.

In Tyumen, Yury Startsev already had told me of the anti-pollution devices incorporated in oil installations and the precautions being taken to prevent oil spills in the region's rivers and lakes.

In Novosibirsk, Nikolai Bezryadin informed me that 47 million roubles had been spent recently on anti-pollution installations. "We know it is costly, very costly," he said, "but the consequences of failing to do this now will be still more costly in the long run."

I asked him about pollution in the Ob River. "It is polluted—but not by industry—for about 20 to 25 kilometres downstream," he replied. "We're cleaning it up and working to restore the fish stocks."

He said his newspaper, *Sovietskaya Sibir*, had spoken out against any industrial development around Lake Baikal.

"We felt it should be preserved because it is unique," he declared. "What our cosmonauts have reported from space has given everyone a new realization of the need to protect the environment."

"Now we're concerned about other proposed projects. We're concerned that proposals to build dams on the Ob to provide water for Uzbekistan and Kazakhstan will dry up the river, although I know that the proposals are still under study and no decision has been made. We're concerned about another proposal to pump water from the Ob to the Kulunda steppe and the Altai Region where water is scarce. Already a pumping station is being built on the Irtysh River. Our fear is that by the time the water is pumped to Central Asia, where we realize it is

needed for agriculture and industry, there will be no water left."

Among the scientists I spoke to in Akademgorodok, Prof Valery Makarov warned: "We must be very careful. Nature is in delicate balance and it's impossible to predict all the consequences. In general, I am against those projects that entail a large-scale interference with nature, but I recognize that every project has to be considered on its merits and that some projects can be undertaken with reasonable assurance that they will not upset the balance. One project, however, that many scientists are against is the building of a canal from the Irtysh River to Karaganda in Kazakhstan. The present canal is between 300 and 400 kilometres long. The new canal would be 1,500 kilometres long."

In Irkutsk, Innokenty Melnikov answered my question in much the same vein.

"We must consider first the territories from which it is proposed to take water and the full impact on the environment and wildlife or we may find that in solving one problem we have created others," he said. "We still have an environment as nature created it thousands of years ago. We have to work with nature to preserve it. If we are reckless, if we are short-sighted, we may find in a few years that we no longer have it."

He cited the cellulose plant at Lake Baikal as an instance of one solution producing another problem.

"The water purification system installed at Baikalsk is the most modern in the world and it was believed it would solve the problem of pollution. But technology has limits imposed by our knowledge at any given time. Sometimes the technology isn't adequate. There are still impurities in the water being discharged into Lake Baikal. So now we must have an enclosed water circulating system."

The debate over Lake Baikal and the Soviet government's measures to preserve it are historic in that they ushered the Soviet Union to the forefront of nations enforcing protection of the environment.

From the start of the industrial revolution in Western Europe, generations worked in mines, smelters and factories under appalling conditions that gave rise to great movements of social

protest while factory chimneys belched smoke and fumes into the air and wastes turned rivers into sewers. Owners amassing fortunes from their mines and factories cared no more for their despoliation of the environment than they did for the wretched conditions of their workers.

Recognition that industrial growth without regard for the environment and disposal of wastes exacts its own retribution in a toll to health far exceeding the cost of environmental safeguards has come with the advancement of science in the post-war years. Yet, in face of scientists' warnings that air and sea cannot indefinitely absorb the poisons being spewed into them, environmentalists in the Western countries must conduct unremitting campaigns against corporations that commission dubious reports to uphold their cases, lobby governments to relax regulations, anything to avoid the cost of anti-pollution devices.

I had heard and read a lot about the debate over Lake Baikal, but I did not get the full story until I sat down with Lyalya in the Hotel Novosibirsk one night and she translated for me a chapter of Leonid Shinkaryov's book published at Irkutsk in 1974, *Siberia: Where It Came From and Where It Is Going*.

The controversy over the pollution of Lake Baikal was touched off in 1954 by a decision of the ministry responsible for the pulp-and-paper industry to seek a site suitable for the manufacture of the high-grade cellulose required for plane tires, which are subjected to temperatures of 300 degrees Celsius on take-off and landing and minus 60 degrees in the air.

Since the plant would need a water supply with a silicon content of not more than one milligram to the litre, this limited the choice of sites, which narrowed down to a choice of four—Lake Ladozhskoye, Lake Onezhskoye and Lake Teletskoye in the Altai, and Lake Baikal. The two first were ruled out right way because there was not enough pine—which is needed for manufacturing cellulose—in the forests around the lakes. Lake Teletskoye met the requirements, but its pine stands contained too high a proportion of silver fir. This left only Lake Baikal and in 1958 site clearing began for two plants at the mouth of the Solzan River.

In 1959 the *Literaturnaya Gazeta* published an article headed "Baikal Must Be a Preserve", attacking the project. While this drew the project to public attention, its effect was offset by articles in other newspapers hailing the project as a major new development.

B. A. Smirnov, the Leningrad designer who is a specialist in pulp-and-paper construction, contended that pulp-and-paper plants no longer were being built as they were in the thirties and forties, asserting that the Baikal plants would have modern water purification systems to ensure that their discharge would not be deleterious to water quality or fish.

With workers volunteering in large numbers for the project, construction of the townsite and roads began.

Then, in an open letter addressed to the State Planning Committees of the Soviet Union and the Russian Federation, a number of scientists and researchers questioned the advisability of the project. This touched off the controversy anew.

The battle was conducted through the press, for and against, some urging the government to proceed, others calling on it to halt the project. Scientist was ranged against scientist.

Mikhail Sholokhov, one of the many prominent writers opposed to the project, urged delegates to the 23rd Congress of the Communist Party in 1966, "Let's be courageous and abandon the idea of cutting forests around Lake Baikal, building the cellulose plants there. Let's build in their place plants that don't threaten this treasure house of the Russian nature—Lake Baikal."

Even before this, the decision had been made to transfer one of the plants to the town of Balakovo on the Volga, although rivers had been considered unsuitable for plant sites because of chemical changes in the water. Shinkaryov's own observation was that the decision had been made "thinking that the defenders of the Volga would be more compliant than the defenders of Baikal".

The debate was brought to a conclusion in 1969 when the USSR Council of Ministers adopted its measures to rationalize and utilize Lake Baikal, in effect setting out guidelines. This was followed in 1971 by another declaration on additional measures to preserve the lake, to remove debris and accumula-

tions of bark, to abandon rafting of logs down rivers flowing into the lake, and to shore up banks around the lake considered to be unstable.

Lake Baikal, the "rich lake" of the Tatars and the "holy sea" of the Mongols, had been saved for future generations, although some scientists are still apprehensive and want even more stringent regulations.

In Ust-Kut, quite by chance, I watched a television program on which Dr Olga Kozlova, who teaches at Irkutsk University, maintained that all discharges into the lake must be ended because even the most advanced purification system was injurious.

So it was that the day after our arrival we set out by road to see Lake Baikal for ourselves, through gently rolling hills and the now familiar landscape of yellow birches and dark pines.

Valery Tanenbaum, the greying, trim deputy chairman of the Irkutsk Committee for Publishing who accompanied us, was full of stories about the lake. One, however, mystified me when he told it.

"Do you know why President Eisenhower particularly wanted to see Lake Baikal during the visit here that was cancelled when Powers was shot down in his U-2 spy plane in 1960?" he asked me.

"I've no idea," I said.

"His father was a director of Lena Goldfields and he himself spent some time at Bodaibo when he was a boy. He wanted to see some of the scenes of his youth."

I knew that Eisenhower had come from a farming family in Kansas, members of a sect called the River Brethren. Unlikely as the story seemed, I could not dispute it. But somewhere, it seemed to me, I had come across a similar story. Not until I was back in Canada did I remember where.

In his book *Sibir: My Discovery of Siberia*, Farley Mowat, the Canadian writer, relates that when he went to Lake Baikal, Mark Sergeyev, the Siberian poet who accompanied him, told him that Eisenhower particularly asked to see Lake Baikal because some branch of his family had tried to acquire a tract of land for a tourist resort there before the revolution. In preparation for Eisenhower's visit the road from Irkutsk to Baikal had

been paved and a road built to a height sometimes referred to locally as Eisenhower's Peak.

There was perhaps one way to resolve the discrepancies. I got in touch with the Dwight D. Eisenhower Library at Abilene, Kansas, where Eisenhower was born. John E. Wickman, the director, replied, as I expected he would, that Eisenhower had never been in Russia as a boy and that "any interest in a Russian company or resort by his father is highly unlikely, although I would be unable to prove this due to the lack of records from this period".

Among the documents Wickman sent me, however, were copies of the speeches Eisenhower had intended to give at Irkutsk. I read them with a feeling of regret for an opportunity lost to improve relations between the U. S. and the Soviet Union because a spy-plane mission could not be reconciled with a presidential goodwill visit and the sentiments Eisenhower had proposed to couch in these words:

"It is my hope that your East and our West, your newer areas and our newer areas, will help us both to concentrate on the future. The mistakes of the past do not have to be repeated. We can and must give ourselves to the cause of the future, to a just, lasting and dynamic peace."

The sun was shining, burnishing the yellow leaves of the birches, as we drove past little villages, the traditional trim of the small log houses brightly painted, past goats and cows grazing by the roadside. Occasionally the enclosing trees would open to a grassy glade or a stream would break in a splash of crystal water from the hillside.

At one point we stopped to walk along a gravel path winding through the trees down a slope.

"There are some reconstructed settlers' houses down here," said Valery. "It will give you an idea of how the wealthier peasants lived a couple of centuries ago."

The houses were large, much larger than I had expected, and they were solid, built of notched logs rising to a peaked roof laid on hewn log rafters. They were dark too, with their small paned windows framed by unpainted shutters. Heavy wooden doors opened to broad planked floors laid with a craftsman's precision. The hand-built furniture, the sleeping areas around

the stove, all conveyed the impression of rough comfort. Outside, in a courtyard enclosed by a high log fence, the barn, storehouses, lofts accessible by stout ladders, were all of the same solid construction, logs and hand-hewn beams. Even the sloped roofs of the outbuildings were built of logs.

I stood on the bank, feeling the sun's warmth, and thought back to log cabins I had lived in, the stoves that gave out a comforting warmth when I got into my bunk at night and the frost inside the window when I rose to the cold of morning because even the most carefully banked fire did not last the night. I tried to imagine this place in the deep snow of winter and concluded that the early settlers had done well. But they had come to stay, to live off the land, not to mine it for its wealth and leave when the wealth was gone.

Lake Baikal revealed itself to us gradually. Presently we were driving beside the wide mouth of the Angara River, past a landing stage from which a river boat was pulling away to round a long curved spit jutting out into the water. Then we were at the lake, looking across the river mouth to the tiny settlement nestled on a shelf at the foot of a cliff. That was where Smirnov had told me Rasputin had his country home. Behind the cliff, curved like a half moon with its bulge to the lake, a little valley followed the curve, dotted here and there with houses which, unlike those on the shelf, would have some shelter from the lake's winds.

Beyond the shelf and its settlement, to the south, the lake stretched in a series of deep bays and wooded headlands. Across the lake, to the east, a range of hills shimmered in the haze. To the north the lake expanded to the great inland sea that it is, the rounded hills running in a long sweep to a rocky point beyond which there was only sky and water. A wide highway, set off by the white guard-rails on its curves, followed the contour of the shoreline.

Thousands of tourists visit Lake Baikal every year from all parts of the world. That morning as we left the buses had been lined up outside the Intourist Hotel loading up their passengers. At the lake though, it seemed that few other than ourselves were there. Most of the cars obviously belonged to the people living in the houses strung out along the base of the wooded

hillsides. Across the road from the unbroken lake front, people were working, digging their potatoes, cutting wood, undisturbed in their tranquil setting. A flock of black-and-white goats trotting along the road scarcely quickened their pace as we drove slowly behind them.

"No one comes to Lake Baikal without tasting its water," declared Valery firmly, taking a glass from the glove compartment.

Dutifully we made our way down to the pebbled beach where, in a fitful change of weather, waves were breaking. We got more water on ourselves than in the glass, but at least we had enough for a taste, although it was Lyalya who wanted her picture taken to prove to her friends in Moscow that she had drunk the famed lake water.

Lake Baikal, as I learned at the Limnological Museum there when we visited it, is 25 million years old and in an active seismic region. Every year some 2,000 tremors are recorded there. One heavy earthquake in 1862 caused a subsidence of the shoreline that created Proval Bay. Another in 1959 shook houses in the same area. The houses, built of durable Siberian larch, withstood the shock, but many of their chimneys and brick stoves did not. And of the chimneys built with cement mortar that remained standing, most were twisted from 35 to 40 degrees clockwise. That earthquake caused the lake bottom to sink up to 15 metres in some places.

The qualities that set the lake apart are not its size—636 kilometres long, 80 kilometres at its widest and 1,620 metres at its deepest, a total area slightly larger than Great Bear Lake and Great Slave Lake in Canada's Northwest Territories—but in its unique life, animals, fishes and plants found nowhere else in the world.

In the tremendous depths of the lake, two fish species known as *golomyanka* have been intensively studied by scientists. What enables the fish, which are transparent, to withstand the enormous water pressures? Ten metres of water are the equivalent of one atmosphere and *golomyanka* have been recorded at depths of 1,400 metres.

In the summer of 1978 researchers used a *Pisces* underwater vehicle to probe the depths of the lake and a model of it stands

in the museum, a tribute to Canadian technology. What the researchers learned delighted them.

"We had always thought the *golomyanka* to be slow fish," the curator told me. "With the *Pisces* we discovered that they moved at different speeds in different layers of water and that at the bottom where the pressures are greatest they moved quicker. We also learned more about our sponges. We had always thought they were creatures of shallow water, but with the *Pisces* we found them at deeper levels."

The lake owes the purity of its water to the richness of its phytoplankton and the whole chain of life dependent on it, part of which is the *epischura* shrimp, a living filtration process that removes pollution, prompting its introduction to the Bratsk Sea a few years ago.

The damage done to many species of animals and fishes in Lake Baikal in the past is now being repaired. The whole area around Lake Baikal has been declared a national park and its animal and plant life is protected. The seal herd, which numbered untold thousands when the Cossack Kurbat Ivanov became the first European to see the lake in 1643, has increased to 70,000 from the remnants of a herd reduced to fewer than 5,000 animals. More than 300 rivers flowing into the lake—only one, the Angara, flows out—are being cleaned of the life-smothering bark deposits from logging and rafting operations now banned, and the fish stocks are recovering. The sacred waters of the native peoples have now become sacred to all.

Baikal is a lake of many moods. When we arrived its waters were rippling in the sun and the cloud banks on the horizon were white. By the time we climbed to the lookout on Chersky Peak, the high point on the north side of the Angara River mouth overlooking the whole area, the mood had changed. A wind had sprung out of the lake and the white clouds had become grey and threatening.

Below us on one side of the rocky point, glimpsed through the trees, were the buildings and spacious grounds of the sanatoria to which people come from all parts of the country. On the other side of the river mouth was the settlement, its houses dwarfed by distance. Ahead the lake spread in an angry mood, its waters churning with whitecaps.

"We get a lot of storms in the fall," Valery said. "A high wind will spring up suddenly and whip up waves anywhere from three to five metres high. We have eleven different winds, each with its own name."

"What's it like in winter?" I asked.

"Baikal is actually warmer in winter and colder in summer," he replied. "The lake does freeze over, of course, but the mouth of the Angara is relatively narrow and it doesn't freeze, so it becomes a refuge for waterfowl. You should see the birds here then. In the winter we have ice roads on the lake for somewhere under three months until the ice becomes unsafe. The ice goes out in May and the navigation season starts in June."

Two men came tramping up the trail behind us. One introduced himself to me as Christo Georgiev, the editor of a Bulgarian travel publication, and for the longest time we stood looking out over the lake.

"Would you describe this as the golden treasure of Siberia?" he asked me presently.

The wind had died down and the whitecaps had smoothed out, but there was nothing soft and golden about the lake at that moment. Where a thin ray of light shone through the dark clouds it flashed cold and brilliant on the water.

"A diamond," I said, "a diamond in the eye of the Siberian giant."

I had been so preoccupied in gazing out across the lake that I had failed to notice strips of what appeared to be paper or cloth dangling from bushes a little way down the cliff. I clambered down to examine them. The strips were cloth, most of them faded by the weather but a few quite fresh.

I recalled that Thomas Atkinson on his travels through Siberia had mentioned some of the traditions of the Buryats accompanying him in the mountains south of Lake Baikal and later I looked up what he had written:

"The pass was not difficult to descend, and we presently reached a small chapel built by the Cossacks on the brink of a deep ravine. Our horses were stopped, the men dismounted, and the Cossacks entered the little building to offer up their thanks for our preservation, and prayers for our further safety, as we had yet some dangers to encounter before reaching the Irkout. The

Bourjiats also make this a sacred spot; and ours hung up a few small pieces of silk on several rods secured on the edge of the rocks."

The Buryat people have had their own Buryat Autonomous Soviet Socialist Republic in the territory south and east of Lake Baikal since 1923. They still raise livestock on a large scale, but no longer as illiterate nomads living in felt *yurtas* and huts, and the growth of industries ranging from meat-packing to metal-working has transformed their national life.

But tradition dies hard and I could think of no tradition better perpetuated than their simple tribute to the beauty of Lake Baikal.

The lake was sacred to all the native peoples living around its shores—to the Buryats from whose word Bai-Kul, meaning "rich lake", it takes its name, to the Mongols who called it Dalai-Nor, the "holy sea", and the Evenks who believed it was the haunt of an irascible spirit, easily roused to fury. It was easy to see how their legend had been inspired.

As we left to return to Irkutsk, the lake's mood changed again. Suddenly a strong wind was lashing the water into a frothing turbulence and it was raining.

I looked at Valery inquiringly. "Which of the eleven winds is this?"

"Well, it's either the *kultuk* or the *verkhovik*, I'm not sure which," he replied. "The worst is the *sarma*. It blows a hurricane."

With the trip to Lake Baikal our stay in Irkutsk was coming to an end. Before we left, however, we had some shopping to do, if we could find what we wanted.

In the geological museum at Akademgorodok, among all the array of exquisitely colored marbles, jades and other fine stones, I had seen one that was completely new to me, with a deep lilac shade. In the case with pieces of the quarried rock were a vase and other objects fashioned from it. We asked our guide what the rock was.

"That's charaite," she said. "It comes from the Chara River in Yakutia and it's the only known deposit in the world. I believe Irkutsk is the only place it's sold."

Her information started us on our last trip around Irkutsk.

IRKUTSK



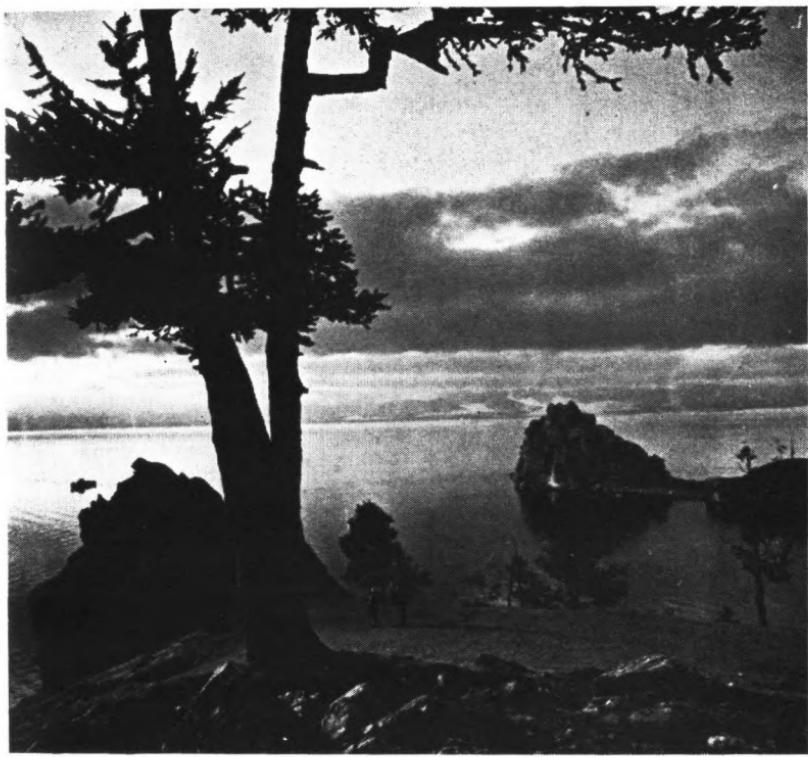
Hotel Angara



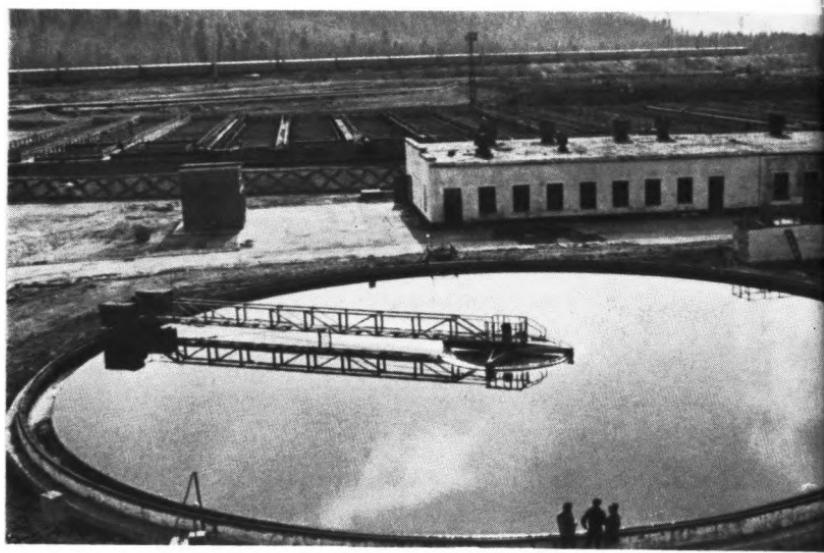
A new construction site in Irkutsk—the Solnechny housing estate,
designed for 100,000 residents



Detail from an old wooden house



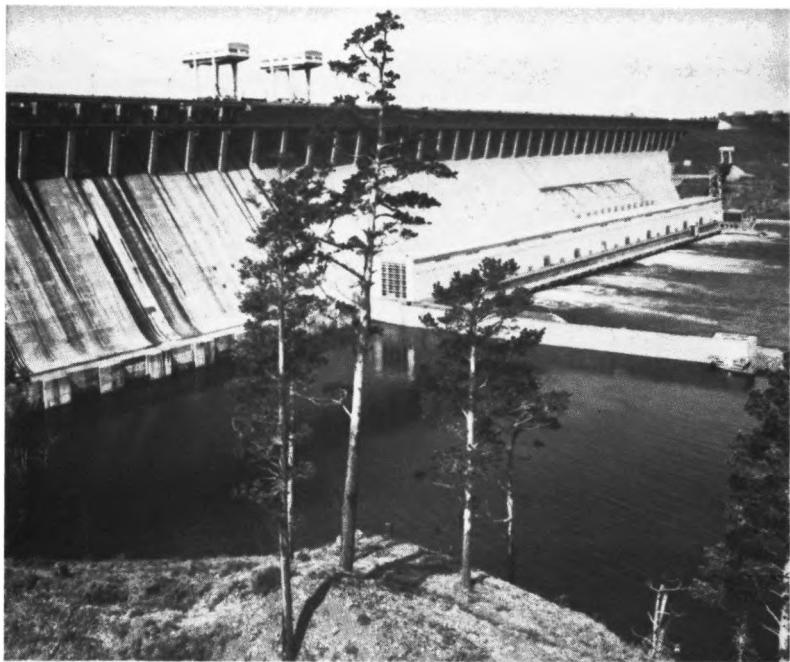
Lake Baikal



Purification facilities at the Baikal pulp-and-paper combine



The main console of purification facilities at the Baikal pulp-and-paper combine



The Bratsk hydroelectric power station—the dam



Bratsk. The residential area for power engineering specialists on the bank of the Angara River



The Bratsk hydroelectric power station—the machine floor



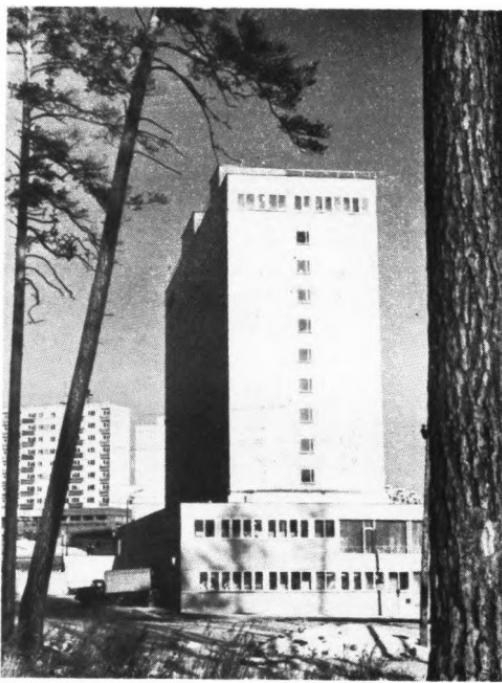


The obelisk honoring the residents of Bratsk who perished in the Great Patriotic War (1941-1945)



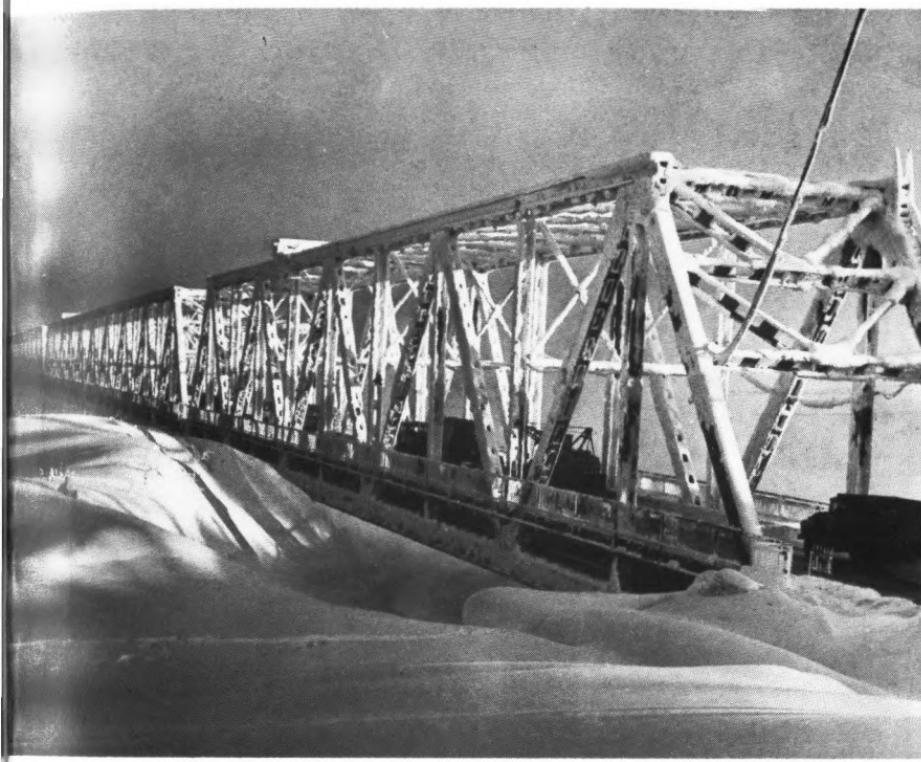
The new city of Ust-Ilimsk mushroomed on the banks of the Angara

The new Hotel Bratsk has accommodation for 1,500 people





The calendar says March, but it's still winter in Siberia. A bridge near Ust-Ilimsk after a snowstorm





Young residents of Ust-Ilimsk

The first two jewelry stores did not have the stone, but the third did. In a glass case behind the counter was a charaite vase which might have been a replica of the one in the museum. It was really a museum piece and not the modest example I had in mind.

"What's the price?" I asked Lyalya.

She asked and told me. "It's 3,200 roubles."

I whistled. Not that I questioned the price, considering the rarity of the stone and the workmanship. But 3,200 roubles at prevailing exchange rates was nearly \$6,000 in Canadian funds.

I settled for a charaite pendant to give to my wife at a mere eight roubles.

CHAPTER VII

New Cities in the Taiga

Ust-Ilimsk is one of the new cities, part of the grand design that will transform the area over the more than 3,000-kilometre length of the Baikal-Amur Railway—it takes its popular name BAM from the initials for Baikalo-Amurskaya Magistral. Unlike Bratsk, some 200 kilometres to the south, which was founded as an *ostrog* in 1631, Ust-Ilimsk has no history beyond the immediate past. The taiga from which it was carved had only a thin scattering of settlements along the rivers, some of them so remote that researchers came to study the Old Russian dialects they had preserved in their isolation.

We passed one of them, Nevon, on our way into Ust-Ilimsk from the airport after our flight from Irkutsk. Its weathered houses standing amid wet fields left the impression of a simple existence, yet they had served their 200 inhabitants well in a self-supporting community that relied for generations on hunting and fishing, keeping a few cattle and sowing enough grain for their needs. Inevitably it will be enveloped by the city.

Innokenty Peretolchin, whose own native village is Peretolchino on the Ilim River, is one who knows the story of Ust-Ilimsk which, for all its brevity, has the strong color of man's struggle to harness untamed nature. He was there from the beginning.

One night he invited me to supper at his house. I found the house among a clutter of shacks by the riverside on the outskirts of town. I had passed them several times and wondered who lived there. They were not old like the houses at Nevon, but rather a ramshackle collection. Some appeared to have been put together from whatever materials their builders could scrounge. Yet on both sides of the Angara River new apartment blocks were going up in every direction.

Inside the house it was surprisingly roomy and comfortable, well furnished and equipped with television, refrigerator, telephone, even hot-water heating.

A solid, stocky man with work-calloused hands, Peretolchin looked pleased at my obvious approval.

"I built this house myself," he said. "It was the first house to go up here. Come outside and you'll see why I chose this spot."

At the back a narrow verandah ran the full length of the house, projecting over the steep river bank. The firs on the bank grew like a hedge in front of it, but where he had cut them back he had a splendid view of the river.

"I've lived most of my life on this river," he told me. "During the war I served on the Transbaikal front and when I got my discharge I decided to go to Angarsk, which is on the river downstream from Irkutsk. I thought it would be a new place, a good place to live. When construction finished there people started talking about Bratsk. Here was another new place, but it wasn't really a new place yet. When I arrived there everyone was living in tents.

"I was handed a barrel and some pipe and told, here's your stove, build yourself a tent. Well, you can live in tents during the summer, but not during our winter. So first we had to build the residences.

"Then we started work on the dam. I became a driller, working on footings for the dam. After we finished work on the basins, we started on the water tunnels, one kilometre long through solid rock. That was hard work at any time. In winter it was doubly hard. We had difficulty in keeping our equipment operating.

"I remember one occasion when the temperature remained as low as minus 54 degrees Celsius for five days. On another occasion we were short of compressed air and the temperature was well below zero, but one section had to be finished. My team volunteered, and using all the compressed air available, we did the job.

"It was all hard work, in many ways harder than it is now because it wasn't as fully mechanized, but there was a lot of satisfaction in doing it.

"It was dangerous work too. All the safety rules and all the

precautions can't completely eliminate the dangers of construction work. My best friend, Boris Ganulin, a team leader, young, strong and full of life, broke his spine and died when he fell from a rock. A cement truck driver fell asleep at the wheel and plunged with his truck into the river. Still, I remember another occasion when precautions did save us from a possible tragedy. A high wind came up and everyone was ordered to quit work. The wind toppled a crane and if the operator had been in it, only a miracle could have saved him.

"Workers on the dam were young and eager. This was the beginning of the team movement—the teams of communist labor. That was the title bestowed on the first three teams at Bratsk.

"I was the leader of one team. I took correspondence courses to obtain higher qualifications and our team worked so well that when people newly graduated from university with their degrees arrived at Bratsk to work, they were assigned to our team for the first two months before they were sent to other jobs. In four years our team produced 14 new team leaders.

"Bratsk was the first great construction site. We were pioneers in every sense of the word and I think we all grasped the idea that what we were doing would be a part of history. People were writing about us, reading about us, singing about us and talking about us and it gave us a great feeling. I'm glad to have been part of it and I marvel at what we accomplished, without an airport, roads or a railway. All those came later."

I asked him why he had not stayed at Bratsk.

"In this country there is always another project, another challenge, if you like. After the work at Bratsk was finished we had a competition to see which team would be the first to come here to Ust-Ilimsk. My team won.

"We had many of the same problems, but by this time we were seasoned workers and we knew better how to cope with them. In the winter of 1974-1975, for instance, the temperature went down to minus 60 degrees Celsius. You would have thought that it was too cold for anyone to work. But no, people wanted to work and they did work. The only difference was that we didn't work outside in such bitter weather the way we did at Bratsk.

"Now there's a city where we pitched out tents a few years

ago, another project finished, another city in the taiga. It's great to be able to look around and say to yourself, I helped to build this."

When men in charge of a great project can so inspire their crews that years afterward their memory kindles a warmth, it is easier to understand why people worked in sub-zero temperatures to complete the project on schedule. That is how Peretolchin spoke of Ivan Naimushin, who was chief of construction at Bratsk, and his chief engineer, Aron Gindin.

"They worked together as a team," he said, "and the men revered them for their fairness, even those they had to discipline. Naimushin had a way with him that won respect. It used to be said that he could go to Premier Kosygin and say he needed more money and even though the money allocated for the project had all been spent, Kosygin knew that when Naimushin said he needed more money he really did need it, and somehow or another the money was found."

Peretolchin's wife and daughter came into the living room to tell us that supper was ready. And it was a supper such as I could expect to get nowhere else. Peretolchin had shot the ducks himself that morning along the river bank. He had gone out on the river to catch *omul*, choicest of all the fish in Siberian waters, and a plate was heaped with thin slices of the white, pink-tinged flesh. It felt soft and fatty in the mouth and it clearly was very rich, but the taste was delicious. The vegetables all came from Peretolchin's own garden.

"People ask me why I continue to live in a shack when I could live in an apartment," Peretolchin said as we talked after supper. "I have been offered an apartment many times, but I don't want to live in an apartment.

"I have my pension because here the pensionable age for men is 55 and for women 50 after 20 years' service in the north—in other parts of the country it's 60 for men and 55 for women. But I have no intention of retiring.

"I want to stay here as long as I can. Eventually, I suppose, I may have to leave. I know the city administration would like to clear all these shacks out of here. They're considered an eyesore. Yet even if I have to move, I want to keep this place as somewhere to come when I feel like it. Here I can shoot ducks, I can

fish, grow my vegetables, and the river is right at my door. That's the way I like it."

Peretolchin, who wants nothing more than to continue living in his shack by the river, is not the only construction worker for whom the river has an irresistible appeal.

I found Ivan Petukhov in his office at the riverport. Elsewhere he would be called a port captain rather than team leader of the hydro-technical team of river-transport workers, for his command includes 52 shallow-draft river boats and 48 barges powered by 156 hp diesel engines and fitted with a specially designed single screw. They operate throughout the navigation season until freeze-up after which a winter road from Bratsk takes over.

A genial man, his bushy black eyebrows contrasting with the long grey moustache worn in the style popular half a century ago, he told me that he got into river work by chance.

Like Peretolchin, he served on the Transbaikal front during the war. Then he went to work on a kolkhoz.

"I became chairman of the kolkhoz when I was 20," he said. "But I wanted to see the mountains, so I joined a geological survey party. One thing led to another. The Irkutsk dam was being built and I went to work on it. After the Irkutsk dam was built, I went to work on the Bratsk dam, and after the Bratsk dam, the Ust-Ilimsk dam.

"For 25 years I was a construction worker and then they transformed me into a river worker. First I was a foreman, then a chief engineer on dam construction, and then in 1976 I was appointed to head the hydro-technical team."

The hydro-technical team, he explained, was formed in 1955 to operate on the Angara at Bratsk. Now it operates from Ust-Ilimsk, transporting equipment—cranes, excavators and bulldozers—to the fourth dam in the series being built at Boguchany.

"The average depth of the Angara is 3.3 metres and it's spaced with rapids and two shallow falls," he pointed out. "There are also flat rocks in a number of places and, in the lower reaches, log rafts."

"Have you lost any equipment in the river?" I asked.

"Yes, quite a bit," he replied. "It's a tricky business navigating this river. The boats are holed frequently. We have boats specially equipped for retrieving machinery when we lose it over-

board. Some boats have been sunk, but none of ours in recent years."

The phone on his desk rang. He picked it up and listened intently for a minute. Putting it down, he said to me, "What did I tell you! We're just had an accident. One of our boats has been holed and we've got to tow her in."

Outside, standing in cradles, were two of the river boats, between 30 and 35 metres in length, bearing signs of recent repair.

No stranger needs to be told that Ust-Ilimsk is a new city. Once beyond the present city centre on the river's west bank, it is apparent.

Over on the east bank new apartments are going up as fast as their builders can erect them and people are moving in before roads and sidewalks can be paved and grounds landscaped. Young people are going to Ust-Ilimsk from all parts of the country, a cross-section of nationalities, and the population, around 80,000 in 1980, is increasing by 15,000 a year.

While they place piles of rags at the entrances to the apartment blocks, rags that soon become heavy with mud and useless, people wait for the roads and sidewalks. But the road-building season is short, from late May to late September. In the meantime, cars jolt through muddy depressions and people pick their way along rough trails at the side of the road where stands of trees separate the apartment complexes. And watching the number of young women pushing baby carriages along the trails, I was quite prepared to accept the claim that Ust-Ilimsk's birthrate is 34 for every 1,000 of population. It is one reason the average age in the city is only twenty-six.

Yuri Fedotov, chairman of the Ust-Ilimsk city executive committee, speaks with the assurance of a man who knows the plan and has guided its transference step by step from the maps of the planners and the blueprints of the engineers to the reality he can see from his window. Already he can visualize the ultimate city with a population of 300,000 to 400,000. As a writer visiting the city for the first time, searching the map for the names of places so new they are not even shown, I had difficulty seeing the plan for the pieces.

"Fifteen years ago there was only wilderness here except for the village at Nevon," he said, waving his hand toward the

window. "First the dam was built, 16 turbines generating about 22 billion kilowatt-hours a year. Next the road from Bratsk was built and the power-transmission lines. Then the railway from Bratsk was built and work was begun on the pulp-and-paper plant at the same time."

Over the years I have listened to a lot of politicians and corporation presidents outline their plans for expansion and development. Sometimes the plans were carried out, more often they were shelved. Fedotov was telling me what had been accomplished. No one had made a huge profit, no one had become suddenly wealthy. The returns were in the rising living standards of the present and the security of the future.

"Kosygin came here in the early years while the dam was still under construction and before the city had really started to take shape," Fedotov continued. "He was critical of the planning. He told us we should plan for a city, not a settlement, and that's what we have done. In 1973 we were given city status.

"The city started on this bank, but most of our building now is on the east bank of the river. That's where our industrial areas are being built and they will be at least 10 kilometres from the new residential areas. Our first airport was down by the river. Already we have moved it farther out. We have widened the highway, which runs where we had intended to put the railway, because it has to take both logging trucks and cars.

"Ust-Ilimsk has been planned from the start as a complex for natural resource processing and related industries, not machine-building, and that's the way it has been developed. We feel we have an assured future. Our annual cut is 6.5 million cubic metres and we know we have enough timber to last a century, even without replanting.

"But we are taking care of the future. We are restoring our forests as we cut, using natural seeding and planned reforestation, although our nurseries are only in the first stages as yet."

Trees are close to the Russian heart, and none closer than the birches that summon the spring and color the fall across the land from Europe to Asia. They shine in poetry, song and

art. Peter the Great imposed severe penalties on those who cut trees without permission and ordered that saws be used in place of axes to reduce waste in cutting. His successors showed no such concern.

Before the revolution the chief users of timber were the government itself through the war office, the railways and the towns. Private landowners cut and cleared without thought for tomorrow. The easiest way to cut the forests and transport the timber was along the railways, so that a widening swath of denuded land stretched back from the rail lines. No attempts were made to replant the cut-over areas, for the forests seemed to continue forever, as once they did in Canada and the U.S. until the clearings merged and the stripped hillsides no longer supported trees.

Siberia's vast timber resources, more than two-thirds of the country's total, were still little touched when Lenin signed the decree on forests which has guided Soviet policy since 1918. His concern was for their preservation, but not only as a major economic resource renewable in perpetuity. As a man who liked nothing better than to tramp off into the woods during his exile in Siberia, he knew their beauty, the sense of peace and tranquility they induced, and this too was stressed in the decree.

Pine, cedar pine, silver fir, birch and larch, valued for the durability of its wood both above and below ground, dominate the taiga. But Siberia also has its Angara pine and its Siberian cedar, a magnificent tree rivalling the cedars of British Columbia and Washington.

Trees in the taiga take from 80 to 120 years to reach maturity and cutting has to be selective. In areas of permafrost where tree roots cannot penetrate and instead spread out, destruction of the thin soil cover leaves deep wounds. Siberia is fortunate that the exploitation of its forests to feed the complex at Ust-Ilimsk and Bratsk comes now when there is both consciousness of the need for conservation and the ability to concentrate all the scientific and technological resources of the socialist state in mastering the problems. Here there is no struggle between big corporations seeking to log the last remaining tracts of prime timber and environmentalists striving to

retain them as ecological preserves for posterity, no conflict between the environmentalists and workers fearing they will not have jobs unless the tracts are opened to logging.

In 1978 a delegation from the Western Canadian region of the International Woodworkers of America, Canada's largest union in the forest industry, covering loggers and millworkers but excluding pulp-and-paper workers who have their own unions, toured Soviet forestry operations at the invitation of the Soviet Timber, Paper and Woodworkers Union.

What impressed the delegation were the innovative measures taken in protecting the health and safety of the logging crews and avoiding damage to the forest soil, impressions conveyed in this excerpt from the report published in the union's paper, the *Western Canadian Lumber Worker*:

"The fallers used a long-handled power saw in felling the trees which allowed them to cut the trees as close as three inches to the ground without bending over. This method of felling drastically reduced the number of back problems among the fallers. The rubber mounted handles and the vibration springs on the saws were noted by the visitors, who were told that the installation of these devices reduced by a marked degree the number of cases of 'white hands', a serious problem fallers develop from power-saw vibrations.

"Another innovation that impressed the visitors was a hydraulic wedge attached to the chain-saw which the faller activated at the appropriate time to determine the direction of the tree's fall. This wedge was capable of felling the most crooked tree with extreme accuracy.

"When sufficient trees were down, a skidder-tractor would gather up the turn with chokers on a face plate lifting the butts off the ground.

"Following this a falling and skidding machine was demonstrated. The felling was done by a large chain-saw arm and the tree's fall was directed by another arm. This machine would go along the face or skidding trail felling and gathering trees until it too had enough for a turn. Both machines hauled out full length trees, limbs, tops and all.

"At the landing a cat-loader would lift the trees into place on the logging truck (called a timber-carrier). The loader was

unusual as the forks or grapple rotated 180 degrees which allowed the trees to be loaded over the cab on the waiting truck. This prevented the ground from being churned up into an even deeper sea of mud.

"Every potential facet of logging in Russia is designed to create the least amount of damage to the environment. The Russians were also proud of the fact that reforestation of the felled areas took place no later than two years after logging activities ceased.

"Other innovations the visitors saw were the use of small shovel pads for the logging trucks to back up on and the flotation type tires on the trucks.

"The comfort of the crew was looked after on the job site where two caravans were located, one as a warming hut and the other as a kitchen and dining-room with a cook, so that the crew would have a hot noon meal."

The delegation was equally impressed by "an immense nursery where not only were the 'commercial' seedlings raised for reforestation, but also many varieties of ornamental trees for city boulevards, edible nut trees and different varieties of shrubs".

Here its members watched "a two-man team working at thinning (juvenile spacing), with many small saplings being moved to allow the selected remaining trees to develop and mature quicker. The power saw used for this purpose was again quite novel. The motor is mounted on a long shaft and turns on a short chain on an approximately 10-inch bar. The long shaft allows the worker to stand upright and the saw handle, made of rubber and spring mounted, reduces the vibration effect".

Extensive as they are, the forests serving the wood processing plants at Ust-Ilimsk and Bratsk have to be managed with scientific precision to ensure a perpetual yield. They must be patrolled constantly against fire and inspected for evidence of infestation. Just as the spruce budworm has killed large stands of balsam fir and spruce across Canada, so a few years ago the silkworm moth destroyed Siberian cedars over huge areas before it was brought under control, not by chemical spraying, but by isolation and use of a previously unknown microbe, named for its discoverer, Yevgeny Talalayev, which at-

tacked only the larvae of the silkworm moth. Care in protecting the forests must be matched by care in logging operations. Nothing can be wasted and damaged areas must be restored promptly.

The perpetual yield system envisages an entire forest being logged and replanted progressively over decades so that at the end of the period the trees in the first section reforested will have grown to maturity and be ready for cutting again.

The demand for wood is enormous. The Bratsk plants in 1980 were producing 800,000 tons of pulp a year and 250,000 tons of other wood products. The Ust-Ilimsk plant, as I saw when I was there, is still in the early stages of production, but already its output was 250,000 tons of fine paper.

"This is a real international plant," they told me. "The Soviet Union designed and erected the buildings. The German Democratic Republic, Poland, Hungary, Bulgaria and Romania all supplied machinery and equipment for which they will be paid out of production according to the amount they invested. This unit you see in operation is a composite of Soviet and French machinery. The log sorting and milling equipment came from the FRG, Finland, the U.S. and Canada."

The adjoining section of the plant stood cavernous and empty, but the machine-beds were in place.

"That's for the next unit which is ready to instal," they said. "That will double our production. And there are still ten more units to be installed before the plant is completed."

The number of new workers required for the plant, the number of new apartments, schools, stores, institutions that must be built, leave no doubt that Ust-Ilimsk's optimum population figure will be reached.

What induces people to leave the older cities in the European republics or, as so many have done, to move from the more established cities in the southern regions of Siberia, to work in these new cities, still raw at the edges? Is it a desire to seek new opportunities in new places, a feeling of greater freedom in breaking from well-worn routines, a sense of adventure, the pioneering spirit reborn in every generation that needs the challenge of new frontiers?

I asked these questions of Margarita Fedotova, the head

of the city executive committee's cultural department. A tall, handsome woman, she won my heart by telling me that I reminded her of her father, making me suddenly conscious of my years. Valery Tanenbaum was accompanying us to Ust-Kut, but he was busy with the problems of his publishing enterprises and Margarita accompanied us everywhere, from supervising the apartment in which we were housed to trudging through the mud of building sites.

"I've been here since 1974," she replied after pondering my questions for a minute. "I can only speak for myself. On my mother's side I am descended from Poles who were exiled to Siberia. My father was Armenian."

I appreciated that. I like Armenia and I like its people. I might easily have been diverted to a discussion of Armenia, but Margarita recalled me to Siberia.

"I came here from Angarsk because they offered me a job," she said. "I like to work with people, not paper, and here I can do that. My husband wanted to go to Moscow, but he came to Ust-Ilimsk with me and he got a job as a hydro-engineer. A year ago he died, leaving me with a daughter who is 10 years old now.

"My first impulse was to leave Ust-Ilimsk, but people were so very kind to me and somehow or another I stayed. I found that I had got used to the city and I didn't want to leave."

I asked the same questions of Alexander Goloshchapov when I went out to see him at the east bank site where his team was building a youth hostel. Now in his forties, lean, tanned, with a ready smile, he was one of the young people who responded to the Komsomol's call to go to Bratsk.

"That was why I came," he said as we talked in his work shack on the site. "I was born in Siberia, at Krasnoyarsk, but my father was killed in the war and I was raised in the Saratov Region on the Volga. I finished my army service just around the time the Komsomol made its appeal. Everybody was talking about Bratsk and I volunteered.

"In 1962 I worked on the road from Bratsk to Ust-Ilimsk. We finished building it five years later, 256 kilometres and most of it through dense taiga. Then I moved to Ust-Ulimsk."

Goloshchapov is a member of the Communist Party's executive

committee in Ust-Ilimsk and a good builder. He was not boasting when he told me that his team was considered one of the best in the city.

"We train young people to be team leaders and other teams take them, but I always keep a nucleus of trained workers."

I probed further, trying to learn what he read, what sports he played, what his cultural interests were, questions that would reveal how his interests had been influenced by the government's lavish expenditures on education, culture and sports.

"What do I read?" he repeated, looking thoughtful. "Two newspapers, the *Ust-Ilimskaya Pravda* and the *Vostochno-Sibirskaya Pravda*. I read *Stroitel*—that means Builder—and several sports publications because I'm a hockey fan. I like reading historical novels. My favorite poets are Lermontov and Voznesensky, although I can't say I really understand Voznesensky. And Yevtushenko's poem about Bratsk has a special appeal for me, of course. As for music, I can tell you what I don't like. My children like rock music, but I can't stand it."

Music is thriving in Ust-Ilimsk, every kind of music. I hardly needed the contagious enthusiasm of the musical director, Valentina Korsikova, to convince me of that when Margarita took me to one of the music schools housed in an older residence.

"There was no building for the school when I came here after I graduated from the music department of the Irkutsk Pedagogical Institute, so they gave us this residence," Valentina reported. "We literally made it over with our own hands. We started with one school and three teachers. Now we have three schools and 35 teachers. The students come here for one or two hours a day in addition to their regular school hours and we try to give them a good training that will deepen their enjoyment of music and bring out all the talent in them."

The sounds of violins and flutes from within closed rooms as we went from floor to floor was proof enough of that.

The first fine snow was falling and melting on the newly built concrete road to the airport as we left to catch our flight for Bratsk, only 35 minutes away by air. When finally we did get a flight, however, two and a half hours later, Aeroflot redeemed itself. The plane was not flying to Bratsk, but it made a special landing there for us. It was still snowing when we arrived.

CHAPTER VIII

Storehouse of Riches

When Germany invaded the Soviet Union in 1941, the Nazis issued a textbook describing Siberia as a bleak country populated by half-wild people, fit for no more than the natural concentration camp they intended to make of it after Germany won the war. Although Bratsk no longer is a young city—it celebrated its 25th anniversary on December 12, 1980—the average age there still is only 28, and it was not where I would have expected to meet a survivor of Buchenwald, one of the most notorious of the Nazi death camps.

Memories of the war and the fervent desire for peace that springs from them are a living force everywhere in the Soviet Union. The memories live in the hearts of the families, the widows and children of the millions who died, in the thoughts of those who fought and lived. Unlike Canadians who have not known an enemy on their soil since the American invasion during the War of 1812, the Soviet people remember the destruction that erased the labors of a generation. If the past is to have any meaning for the present, the symbolism must be part of life.

Wherever I went in the Soviet Union, in the farthest cities of Siberia, the eternal flame burned on memorials sculpted in many forms, always in the city centre where the stream of life flowed by and always with an honour guard of Young Pioneers standing solemnly at attention. Men and women, sometimes children, approached the memorials, added their tributes to the flowers heaped at the base, stood silently for a minute or two and departed.

The depth of feeling that runs through the people wells to the surface when someone you met only that morning and may never see again grasps your hand as you are leaving and speaks

that one word in English . . . peace. The sincerity consumes a mountain of lies about Soviet intentions.

A tall, gaunt man, Stepan Baklanov is a member of the Bratsk Committee for the Defence of Peace. As a former inmate of Buchenwald, he also is a member of the international organization which links those who survived the Nazi death camps across many national borders. "Not," as he says, "to perpetuate the memories of the horrors we experienced, but to make sure that such things never happen again."

Now deputy chief of the Bratsk wood-processing complex's construction department, Baklanov came to tell me about his early experiences after the war when he volunteered to work on construction of the railway from Taishet to Bratsk. He seemed reluctant to talk about his war experiences and I had to question him persistently to elicit the story of his part in the Buchenwald uprising.

His was one of the Soviet army units overrun in the first German offensive that swept to the approaches of Leningrad and Moscow before it was halted by heroic resistance. Encircled in the Minsk region, the survivors of his unit were forced to surrender.

Baklanov was sent first to a prisoner-of-war camp and later he was transferred to Buchenwald. Not until the war ended did he learn why. He had been singled out by the SS as one of those to be liquidated. He was reprieved by the worsening labor shortage in Germany which forced the Nazis to suspend the liquidation order so that the prisoners could be put to work at hard labor, digging ditches and building roads.

At Buchenwald he became one of the leaders of the clandestine anti-fascist organization, embracing prisoners of many nationalities, which organized the uprising of April 11, 1945 and freed the whole camp.

"As news of the German defeats filtered through to us, we began to prepare for the uprising," he said. "In each national group we organized a unit, coordinating all the units through an international committee. To succeed, we had to get arms and we devised various means of getting them. German Communists and other anti-fascists working in arms plants used to steal guns and dismantle them and we found ways of smuggling the parts into the camp, where we could reassemble them

and hide the guns. Prisoners working in the shops stole materials from which we made hand grenades. Everything had to be done with meticulous care to avoid discovery. But," he added with grim humor, "we were graduates of a hard course in survival in which failure meant death.

"Finally we had the arms and we far outnumbered the guards. The committee set April 11 as the date for the uprising. But I was not there to take part in it.

"On April 10 the commandant ordered a number of the prisoners to be evacuated, including some members of the international committee. I was one of them.

"We decided that we would attempt to escape. As the coal train into which we had been herded started to move off, four of us jumped. Immediately the guards opened fire. Three of us landed unharmed, but the last man to jump was hit. The train disappeared down the track without stopping and we got the wounded man away from the railway as fast as we could.

"We were free, but far from out of danger, for we had to stay concealed much of the time, snatch at whatever chance to get food that came our way, and with a wounded man we had to go slowly. It took us several days to reach the shelter of the forest, but there we made contact with some Czech partisans from the Sudeten. For a short time we were volunteers in their operations to harass the retreating German forces. We knew our Soviet troops must be pressing them hard and one day—it was May 9—a Soviet tank column appeared. We went wild with joy. It's a day I shall remember as long as I live."

The war halted plans for construction of a second railway taking a more northerly route across Eastern Siberia which were being discussed as far back as 1924 when the planning commission of the Council of Labor and Defense incorporated a proposed route for the railway in its long-term plan for development of the country's railway network. Eight years later surveyors started mapping a route from Taishet to Tynda.

Gradually the plans took shape. An Institute for the Baikal-Amur Railway Construction Project was established and by 1936 it had completed preliminary surveying and planning for the entire route. It took another four years of work by surveyors

using everything from planes to reindeer, however, before the detailed plans were finished.

In the meantime, a light single-track railway had been built from Oldoi, since renamed Bam, to link the Trans-Siberian Railway with the future Baikal-Amur Railway. That was in 1937. In 1942 the rails had to be lifted and shipped west to the battlefield at Stalingrad where they were relaid as tracks to supply the Soviet forces.

A year later, when the tide of war had turned, work was begun on the 468-kilometre section of the railway at the eastern terminus, from Komsomolsk-on-Amur to the port of Sovietskaya Gavan in the Soviet Far East, and in 1945 it was opened to traffic.

Section by section, the rails stretched ever farther eastward in the postwar years—from Abakan to Taishet, Taishet to Bratsk, Bratsk to Ust-Kut on the Lena River, with a spur line north to Ust-Ilimsk. As the seventies approached, all the field work, all the planning, was complete and work could begin on the major project of spanning the more than 3,000 kilometres between Ust-Kut and Komsomolsk-on-Amur.

It was a bold undertaking. At a time when Canadian and American railways were laying little new track, abandoning feeder lines and curtailing passenger service, a new transcontinental line was building in the USSR, single-tracked and using diesel locomotives, but with provision for eventual double-tracking and electrification over its entire length. The physical problems were formidable. Two great rivers, the Lena and the Amur, and many smaller ones had to be bridged. Tunnels had to be drilled, the longest a 15.3-kilometre tunnel through the Northern Muya Range in a seismic area where permafrost and a temperature range between minus 60 degrees Celsius in winter and 40 degrees above in summer presented extraordinary difficulties. And the line had to traverse taiga and swamp and mountain valleys, skirting those areas where the danger of earthquakes was greatest.

I got an idea of the problems encountered when I talked to Alexander Edelstein, deputy chief of Bamstroiput, the railway construction enterprise. He had the responsibility for building the Abakan-Taishet, Taishet-Ust-Kut and Bratsk-Ust-Ilimsk

sections, and he spoke of them with an engineer's pride of achievement.

"The engineers and the construction workers know the difficulties, for they have to overcome them. Once the railway is built it's harder for others to grasp them. You see the bridges but not the builders. You see the track but not the permafrost over which it's laid.

"In these three sections we had to build more than 100 bridges. Ten of them, including the bridge across the Lena River at Ust-Kut, are major structures. For more than half its length the railway runs through permafrost. And we had to do extensive rock work in many places.

"We started building railways and everything else followed—dams, industries, settlements and cities. We were under no illusions about the difficulties we faced. The first to come here made their way over winter roads. They worked out of shacks in the bitterest winter weather. And somehow or another their enthusiasm overcame all the obstacles."

In his nostalgic recalling of those years I heard an echo of the Sibelectroterm engineers at Novosibirsk.

"The first young people who came here are no longer young. They have grown old in the region they came to develop. Just like me. I came here from the Institute of Railway Transport Engineers 25 years ago. In fact, most of the BAM department heads are those who came here as young men around the same time.

"There's Felix Khodakovsky, who came to work on the Abakan-Taishet line, studied at the institute and now is chief of construction at Severo-Baikalsk at the northern end of Lake Baikal. And Victor Petrov. He started as a foreman, graduated from the institute and built the line to Ust-Ilimsk. Now he's chief of construction at Tynda. The railway is our reward."

Like BAM, the Bratsk dam was dreamed of long before Innocenty Peretolchin went to work on its footings. But it would be 23 years before the gigantic project envisaged in 1938 began generating power in 1961.

Bratsk does not conform to any orthodox city plan, neither the traditional downtown core surrounded by residential suburbs nor the newer central city separated by a greenbelt ring

from outlying satellite towns. From the administrative district it stretches 45 kilometres in a string of eight districts, each an industrial and residential entity. Between them the taiga lies unspoiled, greenbelt areas and their wildlife preserved for future generations.

So it was that in leaving the administrative district we found ourselves driving between woods on either side of a heavily travelled road. Some distance outside the administrative district a separate trucking road for the big wood-processing complex divides the traffic. After that, logging trucks with their heavy loads are a constant temptation for cars to pass where the road affords few safe opportunities. At times our driver had no choice other than to go slowly.

Bratsk dam is at the end of the 45-kilometre stretch. The turbulent black clouds parted as we approached it and brilliant sunshine picked out each pylon in the forest of power lines on the high flat bank of the river below the road. Above us a train moved slowly along the embankment toward the dam.

Poems have been written about the Bratsk dam. Yet it is a poem in itself, with the massive sweep of its concrete face framed at the top by the cap carrying the roadway on its buttresses and the railway across the top. Below the housing at its foot the waters swirl and froth.

The dam was built to provide power for the wood-processing complex and the aluminum plant, one of a series of four—Irkutsk, Bratsk, Ust-Ilimsk and Boguchany—and it is part of the great hydro-network supplying power from Ulan Bator in Outer Mongolia to Prague in Czechoslovakia, where it is linked to the European hydro-network.

The statistics, that the Bratsk dam has an installed capacity of 4.5 million kilowatts and that the total installed capacity of the four dams when all are in operation will be about 13.5 million kilowatts, are the summation of the purpose. But who, in face of the dam's own beauty, is going to remember that the high dam is one kilometre long, that it is more than 100 metres thick and that the Bratsk Sea behind it holds 169 cubic kilometres of water? The grandeur of the dam is unforgettable. It soars above the river, a cathedral to the harmony of man and

nature, a vast hushed nave of modern technology, its consoles of lights monitoring the conversion of energy.

On the far side of the dam, at the foot of his masterpiece, Ivan Naimushin lies buried beneath a simple memorial shaped in the form of a dam.

Driving up an access road to the railway, we parked the car and started to walk across the dam to meet Edelstein, who had driven ahead of us to see a construction crew working on the second track.

As we walked, the weather broke. A cold wind blew across the dam and it was snowing heavily, a wet snow that soon was running down my neck. The Bratsk Sea, shining with light a few minutes earlier, turned leaden and waves began to break at the head of the dam. Edelstein in his heavy coat was well prepared for the snow. I was not. The workers put down their tools and made for a caboose and we crowded in after them.

"If it snows when a guest comes, that's lucky," Edelstein remarked complacently as he introduced me to the team leader, Ilya Golikov, who left the Kaluga Region near Moscow to work on railway construction at Bratsk in 1963.

"I had an urge to go to Siberia and I just came," he said in answer to my question.

Golikov is unlikely to be among those who go to Siberia and return within a few years at the end of a construction project or for any of a number of personal reasons from family ties to inability to adjust to a new life style. His wife is a hospital worker who can get a job wherever they go and for them Siberia is a good country in which to raise their son and daughter. He concedes that cultural opportunities may be more limited, although some of the country's top artists tour the BAM construction sites to give concerts, but believes the country offers its own compensation in outdoor pursuits.

"The culture will come in time," he said. "For the moment we have the culture we create for ourselves. I am very fond of folk music and we have that. I like reading, novels and the classics, especially Tolstoy and Pushkin. We are on a frontier, but it isn't the back of the beyond."

I asked him what he would do when double-tracking of the railway line from Bratsk was finished.

"I shall go to Ust-Kut or one of the sections farther east to work on the BAM there," he answered readily. "When one job is done, another starts."

The snow flurry ended as abruptly as it began. Golikov and his men returned to their work and we walked back along the track to the car. As we approached the watchman's little shack, standing amid its patch of marigolds at the end of the dam, the man came out to speak to us and his little terrier emerged from its kennel, ran the length of its chain and sat up on its haunches in a begging position, barking furiously. Whether or not its bite was worse than its bark, the pose was unconvincing for a watchdog.

We were to go to Ust-Kut that night, but when we got back to the hotel it was clear that we would not go by air. No planes had flown in or out of Ust-Kut for three days and it was uncertain when they would start flying again.

"We'll go by train," Valery announced. "It's only an overnight trip. The train leaves at seven and it gets into Ust-Kut around nine in the morning."

The train did not leave at seven, nor did it leave at eight. When it seemed likely that it would leave at nine we took our bags to the station and joined the people already waiting patiently. Soviet railway stations and airports always seem to be crowded and the Bratsk station was packed with people of all Soviet nationalities, those who had arrived on time talking or reading or dozing on benches and those who had come later sitting on their bags or lying sprawled on the floor. Some just stood at the windows peering out into the darkness beyond the lighted platform.

I sleep soundly on boats and poorly on trains, and the journey to Ust-Kut was no exception. I doubt that anyone on the train slept soundly that night. In the early morning hours I awoke from a fitful sleep to find we were stopped at a station and a debate by invisible disputants was being conducted over loud-speakers. A man would declaim for a few minutes. Then a woman would respond and the man would answer her. It seemed to go on interminably and what it was all about I never did find out.

After that, sleep was impossible. I got up and sat by the

window to watch the dawn break over a landscape of yellow birches and green pines, green firs and yellow larches, red earth and brown earth. Occasionally a little dirt road, dusted with fine snow, wandered off into the otherwise unbroken expanse of the taiga. Then the snow was gone and we were following the placid Kuta River through valleys between low hills over which grey clouds hung like smoke.

I wondered about the tiny settlements we passed more frequently as we neared Ust-Kut, some of them no more than three or four houses in a clearing, their wood neatly cut and piled for the winter, and others a scattering of houses in fields along the river bank. Ust-Kut is one of the old centres whose origin goes back to the seventeenth century and some of the weathered log houses might have been there for a long time, the river their only highway to the outside world. Now the train rumbles past their doors heralding greater changes than the television aerials jutting from their roofs.

The valley opened on to the river flats, the river widened and the first houses of Ust-Kut lay before us.

Of all the riveraine cities of Eastern Siberia, none has a lovelier setting, the banks lined with broad sand beaches, the land rising in long slopes and benches to the crest of wooded hills. From the confluence of the Kuta and Lena rivers, the city is strung eastward along the Lena for some 39 kilometres, the same hills that give it a rare beauty determining the pattern of its growth. As the riverport for everything transported northward down the Lena to Yakutsk, the only place for the railyards is along the river bank and the level land for housing is limited. It can only go up the slopes as the city grows.

"As you can see, we have a problem of building space," Galina Vysokikh, the Communist Party secretary, pointed out as we drove around in her jeep.

Ust-Kut's problems are those of all places suddenly awakened to development and expansion out of a settled pattern that has served them well. Housing, no matter how quickly it is built, cannot satisfy the influx of newcomers, and the population of Ust-Kut was around 60,000 in 1980. Roads which were adequate for a small population cannot accommodate the increased traffic. Everything needs to be done at once, but cannot. Budgets impose

limitations and dictate priorities. The work force is mobile, as Valery knew, since one of the reasons he accompanied us to Ust-Kut was to discuss how to retain workers in short-staffed publishing enterprises when they could earn more on construction sites.

Ust-Kut has all the appearance of a city that has far outgrown its past and has still to attain its future. The past persists in the old log houses, some with their ornamental woodwork brightly painted, others drab and neglected. It is visible in the sprawl of shacks of a much more recent period around the edges of the city, in the muddy outlying roads through which even the jeep ground with difficulty and in the wasteland surrounding earlier apartment buildings down by the river, as though community pride too had been smothered by the mud.

Amid all this, the outline of what can become one of Siberia's most beautiful cities is slowly taking shape. A new institute for river boatmen stands out on a hillside, set in its own well-kept grounds. The broad embankment in front of the Riverport Hotel, lined with birches, commands a superb view of the river and the dock below it from which trim white boats serve the river communities.

The economic development plan that will give Ust-Kut full access to its future is drawn from the known resources of the surrounding region. Within this region there are deposits of iron, tin, tungsten and manganese, bauxite, apatite and graphite. There are extensive deposits of salt. And there is oil and gas. When the railway is completed these are the riches that will provide the foundation for the complex proposed for Ust-Kut.

Years of methodical surveys preceded the day in 1974 that a striped post was driven into the ground at Ust-Kut to mark the start of BAM construction.

As far back as 1949 geologists discovered the tremendous copper deposits in the Udokan Range northeast of Lake Baikal and in 1960 plans for their development were drawn up. Now BAM makes them accessible. To reach the ore body beneath the mountains, some 90 million cubic metres of rock will have to be stripped away. Then the ore can be mined by open pit methods. It will be carried in 200-ton trucks to a new concentration mill to be built in the Chara Valley, the largest in the

country, and to the problems posed by permafrost and climate will be added that of averting smog, for atmospheric conditions in the valley are conducive to inversions.

The Udkan copper deposits are only a part of the mineral wealth, some of it known for years and some of it recently discovered, to be tapped by BAM, including the deposits of fibrous asbestos in the upper reaches of the Muya River in the Buryat ASSR.

The line running northward to Tynda on the main BAM line, and now extended to Berkakit in southern Yakutia, will tap an area considered by many to be even richer than the Urals in mineral resources.

The Neryungri coal deposit there has an estimated 40 billion tons of hard coal, most of it coking coal. To the north of this coal deposit, within a 100-kilometre range, are the extensive Aldan iron ore deposits, with reserves of between 25 and 30 billion tons yielding up to 40 percent iron. The raw materials are there for creating a great new iron-and-steel complex, which would be the largest in Siberia, particularly with the discovery of other huge iron-ore deposits in the Chara-Tokinsk and Olekma-Amginsk areas, part of them on the BAM route.

Anticipating that the Neryungri field will become a major source of coal exports to the Pacific Rim countries, the Soviet Union already has signed an agreement with Japan for delivery of coking concentrates, starting in 1983, in return for machinery and equipment in order to expedite development of a program that envisages the construction of a new coal town for a population of 25,000 to 30,000 and building of an industrial complex.

As if all this were not enough, oil is known to exist in commercial quantities in the Lena-Vilyui area, major gas and oil deposits have been mapped out there, presaging the emergence of Eastern Siberia as a source of energy from hydropower, coal, gas and oil alike.

Other surveys have delineated the areas prone to tremors and earthquakes, the areas of permafrost and the areas subject to landslides. Part of the BAM route runs through what is known as the Mongol-Baikal seismic belt where the earth constantly shivers with tremors, most of them so light that only the most sensitive instruments can record them. But six severe earthquakes

have shaken the western and central areas of this zone within the past quarter of a century, one the Northern Muya earthquake of 1957, and the country is scarred by traces of past earthquakes remembered, if at all, in native legend. In planning the route to avoid the most unstable of these areas and deciding the type of construction on building sites, surveyors and engineers have had to draw on all the experience gained in earthquake-prone regions of the Soviet Union from the Caucasus to the Far East.

They found that 330 kilometres of the route traversed areas where destruction of the permafrost would intensify seismic activity by as much as two or three points on the Richter scale.

Ways had to be found to insulate the roadbed to conserve the permafrost and ensure that freezing of the upper layer in winter and the swelling accompanying thawing in summer would not warp the rails. Scientists proposed the use of foam plastic or a similar material to insulate the roadbed. Reconstruction of the line from Bam to Tynda had suggested another solution. In some places the thawed permafrost had engulfed the original roadbed. In others, where the roadbed was built up with boulders, the roadbed was intact. Archeologists, drawing on their knowledge of ancient burial sites, explained why. The boulders allowed air to circulate beneath the covering of earth, preserving the permafrost.

Bridge builders too faced problems with permafrost and solved them in constructing the bridge across the Lena River east of Ust-Kut by using metal pipes filled with kerosene which stays cold in summer and holds the frost in the soil.

Of all the surveys whose findings were incorporated in the meticulous preparations for construction of BAM, none was more unusual than the study which led to the route being divided in 28 medico-geographical areas.

Siberians wise in the lore of the taiga have always tended to avoid it, and particularly the more open new growth areas, during the early spring after the snow has gone, and for the same reasons that Canadians in tick-infested areas examine themselves carefully if they have to go into the bush at that time of year.

Until Yevgeny Pavlovsky, an outstanding Soviet scientist, conducted his studies in the thirties, however, the connection had not

been established between the *Ixodes* tick and cases of encephalitis which occurred most frequently in spring, causing high fever, severe headache, disorder of the central nervous system and ending in death or paralysis. The tick transmitted the disease, just as the milder Rocky Mountain spotted fever, with its symptoms of high fever and muscle, joint and bone pains, is transmitted by a tick. Cases of encephalitis have also been traced to mosquitoes, as they have in Canada. Now Siberians whose work takes them into the taiga are inoculated against encephalitis.

The medico-geographical survey has compiled maps of the habitats of various blood-sucking parasites and biting flies—and Siberia has many of them—and recommended ways of combatting them. I doubt though that it has been any more successful in relieving the miseries inflicted by the midges that infest the swamps and the taiga than their Canadian counterparts have been in devising an effective defense against the blackflies and the maddening “no-see-ums” that make life intolerable in the north.

As one of its purposes, the medico-geographical survey carried out by the Institute of Geography at Irkutsk under Boris Prokhorov, studied adaptability to the widely varying conditions workers would encounter in the 28 districts into which they divided the BAM route. The findings, set out in recommendations for medical care, precautions to be taken against snow blindness in certain areas, clothing to be worn in a range of temperatures from minus 65 degrees Celsius in winter to 40 degrees above in summer, and the physical effects of work in mountainous terrain, constitute a comprehensive Siberian manual.

In the years since the first rail section was laid at Ust-Kut, construction of BAM has been under way at several points and new names are appearing on the map. But names of towns and settlements, I soon learned, do not necessarily coincide with station names. The station in Ust-Kut is Lena (East Lena is in the neighbor village Yakurim), just as its riverport has its own name, Osetrovo. The station at Zvezdny, the first settlement to the east, is Tayura, but the next station has the same name as the settlement, Niya. And it was to Niya that we were going to see one of the new settlements under construction and talk to the builders.

CHAPTER IX

Railway to the Future

Even before I clambered aboard the rail car at the Lena bridge I had heard the stories about the early days of the railway when the first group set out from Yakurim to build a winter road to Tayura. Those early days were just a few years past, still fresh in memory, and yet already, as new achievements crowded in on the old, people were beginning to look upon them as history.

Few events in modern times have been as well recorded as the building of BAM. Newspaper correspondents fly in from Moscow to settlements along the line to gather their impressions. Television crews take the opening of every new section to an audience of millions. Writers add to the lengthening list of books about the railway. Everyone in the country knows about BAM.

The same thing, unfortunately, cannot be said about Canada and the United States. Few people even know that a new railway is being constructed across Siberia, an important event by any standard of newsworthiness but one most newspapers have contrived to ignore.

Apart from the scale of the undertaking and the obstacles to be surmounted, aside from its economic impact, what is different about BAM is the way it has captured the imagination of young people, fired their idealism and presented them with a challenge.

From the day the 17th Congress of the Komsomol made its dramatic call, volunteers have been responding and the response has not lessened. The applications pour in and the young people continue to go. They are not young people made desperate by unemployment, for there is a labor shortage and no lack of jobs. They are not lured just by the prospect of high wages and making a stake. The opportunity they see is inherent in the appeal of a new territory and their understanding of its significance to their socialist system.

At Ust-Kut people told me about that first group of 16—14 young men and two young women—who set out in January 1974 to build the winter road, 64 kilometres to Tayura.

While the men felled trees ahead of the bulldozer uprooting and piling the stumps, the two women, Tanya Alferova and Galya Nefedova, worked in the mobile kitchen which was dragged by a bulldozer from one campsite to the next as the men cut their way high above the river. At times they worked in snow up to their knees. The ground was as hard as rock. Driving the supports for the wooden bridges they built was back-breaking work. Even fetching water was an arduous job. But in a month they had cut their way to the Tayura River and driven the first stake for the settlement they named Zvezdny after the cosmonauts' training centre outside Moscow.

For three and a half centuries there had been nothing more along these hillsides than hunters' trails since Pantelei Pyanda and his group of fur-hunters reached the Lena and sailed down it in the first quarter of the seventeenth century. The Yakuts the fur-hunters encountered called the river the Yuluene, a word they corrupted to Elena, and it has come down in history as the Lena.

The prized sable was abundant along the river and, as they had done elsewhere in their eastward surge across Siberia, the fur-hunters pursued it almost to extinction. Now, after a five-year ban on hunting before the war and the release of 20,000 penreared sables in the postwar period, the sable is flourishing again.

A squirrel-hunter was the first to greet the young trail-blazers after they reached the Tayura. Attracted by the noise of the bulldozer and the crashing of trees, he had come to find out what was going on. They were as surprised as he was and even more surprised when he offered them the use of his cabin. Hunters are hospitable, glad to have company for a day or two to relieve the loneliness, but resentful of intrusion into their wilderness. But settlements along the Tayura are far apart, pinpoints in the vastness of the taiga, and the railway was no threat to his hunting grounds.

A few days after the trail-blazers reached the river the first truck convoy jolted its way over the road bringing materials and equipment to begin the work of building the settlement.

The event that focussed attention on BAM was the send-off given in Moscow for the train carrying the first 600 young volunteers from the Komsomol congress wearing their new green uniforms with the BAM insignia. Decorated with banners proclaiming their mission, the train made a triumphal journey across the country. Television cameras filmed its progress and newspaper photographers recorded the crowds welcoming the volunteers with flowers at every city and town along the route.

At Taishet, the junction of the Trans-Siberian and BAM lines, the volunteers divided into two groups, one to go southeast over the Trans-Siberian to work on the line being built northward from Bam station on the Trans-Siberian to connect it with Tyn-dy on the BAM Railway, the other to go east to Ust-Kut over the BAM line to work at Zvezdny. Railwaymen at Taishet presented each group with half of a symbolic key to be joined together again when the silver spike was driven to mark the linking up of the sections being built from both ends of the BAM route.

By the time the volunteers bound for Zvezdny reached Ust-Kut, thaw had rendered the winter road impassable. They had to be taken in by helicopter.

"At times the sky seemed to be full of helicopters of every size and type," Nina Zhdanova, the reporter for the *Lena Kommunist*, said to me as we seated ourselves in the self-propelled rail car, something like a streetcar, for the journey to Niya. Her editor had assigned her to accompany us, swelling our party to four, Nina, Lyalya, Valery and myself, and it occurred to me that our arrival might present some accommodation problems. As it turned out, they were used to having guests at Niya, from concert groups and visiting specialists to correspondents looking for a story.

Nina was a Siberian, born in the Krasnoyarsk Region, and her broad, good-humored face denoted her native ancestry. For her, going over the BAM line was a routine assignment but one in which she would always have a personal interest because she had worked with the volunteers at Zvezdny.

"I was studying at Irkutsk University and I wanted to write my thesis on BAM," she said. "To gather material first hand, I got permission to work on BAM for four months, and in 1975 I

went to Zvezdny. It was just a tent settlement supplied by helicopter then.

"We had about 1,000 young people in the camp, every nationality and from every part of the country. They cut the right of way from Lena to Zvezdny and worked alongside the railway construction workers who were grading the roadbed, building bridges and laying the track.

"My job was to lay the hot-water pipe in the settlement, and all of it had to be completely insulated on the job to protect the permafrost.

"Sometimes the temperature fell to minus 50 degrees. We made our own stoves from oil drums, lived in tents, slept in our clothes, and still we were cold. Once I woke up in the morning and found that I couldn't raise my head—my hair was frozen to the side of the tent.

"We worked hard, but no one was ill, although some people from the southern republics had to be sent out of the camp because they couldn't stand the cold. We had no liquor in the camp. No one particularly wanted it. We just had a tremendous spirit. Everyone worked together and everyone shared. Everything was open and nothing was ever locked. I know it sounds hackneyed, but we really were one great international family.

"What made us feel so great was the support we got—gifts of just about everything poured in from all across the country and we had the best of food and clothing. With that kind of support, nothing was too difficult for us."

The rail car started off across the Lena bridge and I became aware that while Nina had been talking about the cold, the area around the wood stove in the centre was becoming unbearably hot. We shifted away from it and it was still too hot and presently the driver beckoned me up front to his compartment where I could watch the country unfold as we climbed steadily above the river.

The view from this elevation was magnificent, the river far below glimpsed through the trees, the tops of the hills on the opposite bank gradually becoming level until eventually I was looking over them. I might have been on the White Pass and Yukon Railway, except that here there were no snow-capped peaks, only hills and low mountains clad to their summits in trees.

I asked Nina about the hunting and fishing.

"People have always hunted and fished along the river," she replied. "It's almost a way of life even when they no longer depend on it for a living. Now that settlements are growing up along the railway line there are more and more people and I suppose it will have an effect. One of the first people at Zvezdny was a game warden sent to recommend regulations to protect the wildlife."

The first train into Zvezdny did not go on wheels—it went on skis. The story was one of the many I heard at Ust-Kut and by all accounts it was a feat of ingenuity and skill. The train was a power-train, needed to replace the portable units and capable of supplying power to the entire settlement. The problem was how to get it to Zvezdny.

Just before freeze-up in the fall when the first sludge ice already was floating down the river, the 68-ton power train was loaded on to a barge by tractors at Ust-Kut and eventually unloaded on to sandbank close to the winter road. When the Lena froze over and truck traffic began to roll on the winter road, Victor Melnikov, chief mechanic on construction train No. 266 at Ust-Kut, suggested a way of getting the power train to Zvezdny.

Melnikov's idea was daring—place the front wheels of the train on skis, use the rear wheels as brakes and control the train by wire ropes attached to bulldozers. Not everyone favored the idea. It was too risky, even dangerous. The train might topple over and crush a bulldozer or it might go plunging down the hillside. But Melnikov went ahead, confident that it could be done, and his bulldozer operators were as confident as he was—they would do it.

First the train had to be moved off the sandbank and mounted on the skis prepared for it. Then it had to be moved to the snow road. From that point it was a nerve-wracking struggle to maneuver the train up slopes, to hold it securely and prevent it from skidding downhill. At the end of several days Zvezdny was in sight and only the descent to the settlement remained to be negotiated. Twice on that descent the train started to skid and each time skillful work by the bulldozer operators halted it. The train was delivered safely, as Melnikov had been confident it would be, and Zvezdny had its power.

By contrast, our journey to Zvezdny was a sightseeing tour.



The year 1974. The first All-Union Komsomol Shock Detachment arrives at BAM



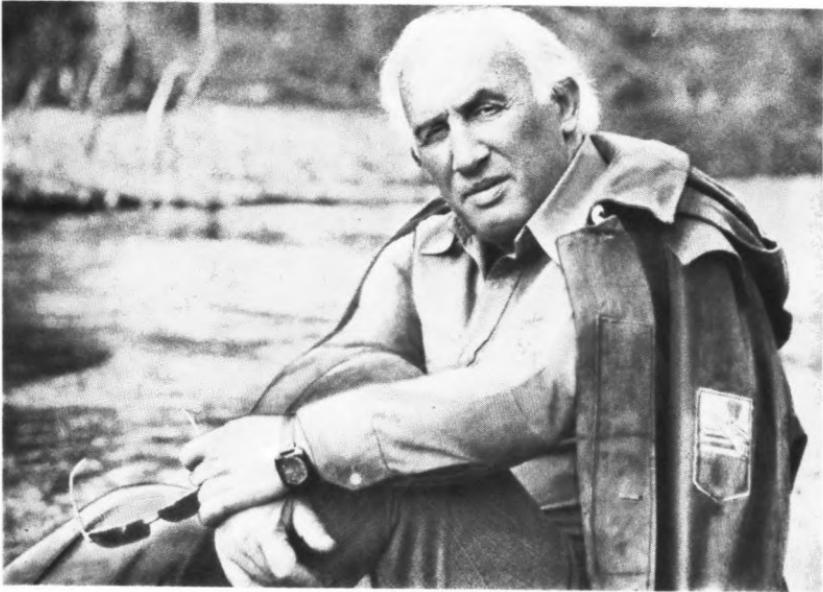
Laying the rails on the BAM track



Another group of volunteers has arrived at the BAM construction site



The city of Ust-Kut, the starting point of BAM, is being born anew



Anzor Dvalishvili, head of the Georgian builders at BAM



Niya, a settlement of BAM builders from Georgia, is going up here
in the distant taiga



Builders of the settlement of Niya

The tent city was gone, replaced on the hillside by houses and apartment blocks, most of them occupied and the rest still under construction. Except for a narrow stretch along the Tayura River, flowing gently over its clear bottom then but undoubtedly a torrent in spring, there was little level land and rail lines loaded with cars and equipment took what there was. The settlement was carved out of the long slope of the hillside. Eventually it will be a town for railway workers and their families with a population of some 700, and that well may double if the town is expanded for the forestry settlement planned for the Tayura River site.

Each of the settlements being built along the BAM route is the responsibility of a republic or a region. Zvezdny is the responsibility of Armenia, Niya, both the station and the settlement, is the responsibility of Georgia. Farther east, Magistralny, the station for Kirenga founded by Komsomol volunteers in 1974, is the responsibility of the Rostov Region.

After Zvezdny, still climbing gradually, we stopped twice, once to check with a railway guard where gravel stripped from the hillside had left a long flat clearing and once to pick up a couple of hunters who flagged us down and wearily clambered aboard. It was still a few kilometres to Niya.

Anzor Dvalishvili, chief of construction at Niya, a big rawboned Georgian, was waiting for us at the station. He held out one big hand in welcome, grabbed a bag with the other and proceeded to stow our luggage in the back of his jeep until it seemed impossible that there would be any room for passengers. Somehow or other we all squeezed in and with the expertness of long practice he maneuvered the jeep up the road running diagonally across the hillside, slithering through the mud, to the settlement on the next level.

Jammed as we were in the jeep, it was difficult to see much, but eventually we stopped outside a house, only it proved to be a duplex—a three bedroom guest-house on one side and its counterpart, in which Anzor and his family lived, on the other.

"Make yourself at home," he said after we retrieved our bags from the innermost recesses of the jeep and carried them inside. "Everything is here—bathroom, refrigerator, stove—and if there's anything more you need, just ask for it."

A Georgian contingent is building the settlement and as far as

possible in a region and climate so unlike their own, they have reconstituted a small piece of their republic at Niya, bringing their customs, their culture, their cuisine and their traditional hospitality with them.

At supper that night in the small dining-room used for guests we had a succession of Georgian dishes, Georgian wine, Georgian cognac, even Georgian cigarettes, and when Anzor asked me what I thought of the smooth Georgian cognac—"the best in the country"—it took all my diplomacy to praise it without feeling disloyal to my Armenian friends who know my taste for their cognac.

We also met Anzor's dogs at supper. It would have been difficult not to do so because, like my own, they have never been taught not to beg at the table and now consider tidbits from family and guests as part of their inalienable rights. As far as I was able to determine, Anzor owned four of them, two small dogs of Maltese origin, a smooth-haired terrier of uncertain antecedents and a husky cross, the only one barred from the table. To confuse things more, two of the dogs appeared to be named Niya.

That night Anzor reappeared at our door with an invitation. "Let's go and see how the young people are doing," he suggested.

The young people proved to be, not his own two daughters but students at the secondary school, of which his wife Nadezhda Khnykina, a former Olympic Games bronze medallist in the 200 metres and long jump and a Soviet gold medallist, is the director. Some of them had formed their own rock group and were holding a concert rehearsal for us. Naturally, some of the songs had a Georgian flavor and they digressed from their professional style to include in their program a small boy in Georgian costume performing a Georgian dance. But they were good.

Our next invitation was to a showing of Georgian films in a hall whose utilitarian exterior was belied by the artistic finish of its interior. Photographs of outstanding Georgians killed in the Second World War and faded newspaper clippings relating their exploits held a place of honor in the vestibule. Inside the hall photographs of site clearing for the settlement and of the first prefabricated house being lifted into place by a helicopter were

displayed side by side with photographs of projects built by Anzor in Tbilisi, Georgia and Pitsunda, Abkhazia.

"I'm not a railway expert, but then, we're not building a railway here, we're building a settlement, and I am a construction man," Anzor explained. "When our State Council of Ministers decided that Georgia would be responsible for building this settlement and the Communist Party's Central Committee recommended me to head the project, I didn't know what to expect. I had headed building projects in Tbilisi and Pitsunda, and I had built refrigeration facilities in Teheran, but this was different."

"There was nothing here when I came on a survey, nothing but virgin taiga in every direction. Now here we are, 350 families and all from Georgia, in far-off Siberia charged with building an entire new settlement. Come around in the morning and I'll show you what we've done."

The next morning I found a trail and followed it into the taiga for a short distance until I came to a dead end. The trees grew closely, but most of them were tall and spindly and there seemed to be a lot of dead trees standing. I had thought of trying to find the Niya, the small river that winds past the settlement and joins the Tayura River at Zvezdny, to end as a tributary of the Lena where the early settlers built their village and called it Tayura. The only place to walk in the open, as in so many Canadian railway communities, was along the railway, either up the track or down the track. I abandoned the idea and went back to look for Anzor.

I found him in the long wooden building, set high off the ground, which served as his administration offices. Anzor was solicitous about my health; was I sleeping well and getting a rest, and what more was there I needed to know? I told him that my immediate problem was in sorting out the many settlements being built along the BAM route—I knew there were 60 of them between Ust-Kut and Komsomolsk-on-Amur—because none of the maps I had showed them.

He took me over to a big plasticized map on the wall and pointed out places along the route. "This doesn't give you everything", he said. "See, here's Tayura, but Zvezdny isn't shown beside it. It does show most of the places." Then, with a character-

istically generous gesture, he unpinned the map from the wall, folded it and handed it to me. "Take it, if it will help you. I can get another."

Shrugging into his parka, he took me around to the side of the building where he had parked his jeep.

"Now," he declared, "we'll see what you think of our new settlement buildings."

The new buildings lay at the other end of the cleared site, separated from the temporary buildings by a wide expanse of churned mud, the reason I had not ventured there earlier.

Seen close up, the concept for the new settlement was daring and imaginative. Here on this broad, gently sloping bench, surrounded by the dark brooding taiga, Anzor's Georgian construction workers already had erected a number of two-storey houses, each set back from its neighbor where they were built in short rows, and each group set at an angle from the next. Behind them were three tall apartment houses, five storeys under the long shallow front roof and six storeys under the short steep roof at the back. To the side was a long block of townhouses. The new school, a low white building, was at the centre so that no students would have far to go in winter. With the varied facings of grey and red brick offsetting the white finish, the whole development would have graced any city. For a railway town with a planned population of around 700, in a hitherto remote area associated with log houses for centuries, it was extraordinary.

"When all the BAM settlements are built and the new industrial complexes are in operation," Anzor remarked, "a lot of people are going to have to change their ideas about Siberia."

Vladimir Chamakhashvili, chief engineer for the construction project, who came to Siberia to build a chemical complex at Angarsk and then volunteered to work on BAM, enlarged on his own ideas when I talked to him after supper that night.

"We're building on unfamiliar territory, but our concern here is the same as it would be anywhere, to build something beautiful. That was my concern when I helped to build Rustavi outside Tbilisi. This is a very different setting so we had to create buildings in harmony with it, buildings that people will think about in a few years' time as being part of their surroundings, as belonging here."

Others agreed with him. Whether they remained after the project was finished or returned to Georgia, they wanted to leave something that future travellers over the BAM route would be able to admire.

All those at the table that night had come with the first team—Anzor Liliashvili, the quiet construction foreman, Rafael Melkumov, the economic planner who found his first trade more in demand, and Vladimir Nikolayev, the construction engineer who knew the hazards of the ice road.

"So many of us volunteered that the first team had to be selected," said Liliashvili. "I helped to cut the right of way and I was working on the railway when I heard that Georgia had adopted Niya. Naturally, I asked to be transferred here."

"I'm also a blacksmith," Melkumov explained. "To qualify myself as an economic planner, I studied at the polytechnical institute and worked at my trade as a blacksmith by day. I came to Niya as a planner, but in my first days here I found I was putting in a lot more time in the smithy."

"And I came over the winter road," Nikolayev said. "When break-up time on the river neared, we used to drive with the truck doors open, ready to jump if the wheels went through the ice. We lived beside the winter road, in tents on the river bank. After the ice went out, the only way to get anything here was by helicopter."

On the hillsides across from the settlement were the huge black scars of a forest fire, still unhealed. The fire must have been a big one, by the look of it, and not many years ago. I had noticed the scars the first morning after we arrived at Niya and wondered about them because I had seen no traces of fire elsewhere.

With its millions of hectares of forests, Siberia does have forest fires, particularly in a long hot summer when the taiga becomes tinder dry and new fires break out daily. To fight them, new methods have been devised, the newest a kind of explosive rope which can be played out along the edges of a fire and set off to blast a firebreak. And a satellite surveillance system is planned to maintain a watch over the taiga and inform forest protection workers by radio of new outbreaks.

I asked Nikolayev about the fire at Niya.

"Yes, it was a big fire", he replied. "It broke out in the sum-

mer of 1975 and every man here—there were about 70 of us at the time—went to work fighting it. But we couldn't get it under control. Finally we had to send out a radio call for help over a designated channel. We got no reply and we had to send out an open call. The Chinese across the border heard it and set up interference to prevent our call from being heard.

"Fortunately, our call was heard or the fire might have raged over the whole area and destroyed everything in the settlement. The workers at Zvezdny had gone to work an hour earlier than usual that morning. They picked up our call and sent about 20 men in a helicopter to help us. With their help, we finally got the fire under control.

"After that experience, no one has to tell us about the danger of fire in the taiga. Those scars will be there for a long time."

I asked Melkumov, who himself had studied at night to become an economic planner, how students at the secondary school got a higher education.

"That's no problem," he said. "They can apply at a university or institute or they can take correspondence courses. About 150 people here have taken courses already at institutes in Irkutsk. They don't have to go to Irkutsk to take their examinations—the examiners come here from Irkutsk."

We might have stayed longer at Niya or gone farther east to the end of construction at Davan, at 1,000 metres, twice the elevation at Niya, and the highest point on the western section of the line. A telephone call from Ust-Kut, however, advised us that planes were expected to start flying out of Ust-Kut again in the morning and if we wanted to be aboard, we had to return early. The rail car was making a special trip to take us back.

It was dark and the stars were bright at 4:30 the next morning when we got into the bus which had lumbered through the mud to the end of the boardwalk and lurched down the hill to the station. There, handing our bags across the track to willing hands, we said goodbye to Anzor, who in bridging the Siberian taiga had given us a glimpse of Georgia.

We entered the rail car out of the chill of early morning, but the stove was so hot that none of us could sit near it for more than a few minutes. Nikolayev and Chamakhashvili, who had decided to go down to Ust-Kut with us, went up to the front of

the car, since the driver was now operating it from the rear, and whiled away the time cracking cedar nuts. Soon they had quite a pile of husks.

The stars vanished and the dawn broke grey and wet behind a veil of cloud. The taiga remained dark and unbroken until, a few kilometres from Zvezdny, the headlights of a vehicle negotiating an unseen road broke out of the half-light and accompanied us for a short time before they disappeared. Then we were in Zvezdny, its lights strung brightly along the beach and the river bank, stopping only long enough to take on more passengers. The taiga closed in again and soon we were starting the long descent to the Lena River.

It was daylight before we reached the Lena bridge where we expected Galina to be waiting for us, perhaps to take us directly to the airport. No one was there. Nikolayev and Chamakhashvili wished us well and got off.

Nina went to phone for a car.

We piled our bags into the jeep when it came and set off for the Riverport Hotel, and that is where Galina caught up with us some time later, full of apologies. Her car had broken down on her way to meet us at the bridge.

"I'm sorry," she announced. "Yesterday we were told the planes were expected to start flying this morning. They're still not flying and we won't know until noon whether they will go today. We hope they will."

I looked outside at the drizzling rain and the mist hanging low over the hills and hoped so too. But I had my doubts.

Noon passed and the planes still were not flying; then two o'clock, four o'clock, and it became obvious that there would be no planes that day.

Valery was returning to Irkutsk and was becoming concerned about an enforced stay in Ust-Kut. But we were flying to Yakutsk. While we waited, we debated what we should do. We could take the train back to Bratsk, with no assurance that we could get a flight there to Yakutsk.

The alternative was to take a riverboat down the Lena to Yakutsk, an idea that appealed to me, for it would give me an opportunity to talk to people in centuries-old villages, to see the oilfield at Markovo where the first well was brought in back

in 1962, and to sail past the *Stolby*, the rock formations weathered into fantastic shapes that line a 60-kilometre stretch of the river below Kirensk.

It was a tempting idea, but not practical. The riverboat would not be leaving for two or three days and it was a four-day trip to Yakutsk. If we took the boat, we would lose a week from our itinerary and all the arrangements made long ago for us all the way to Ashkhabad in Turkmenia would be thrown into confusion. We could only wait and hope that the planes would still be flying tomorrow.

They were flying, although when I got up and saw the fog along the river my hopes were not high. But at the airfield, on the hilltop above Ust-Kut, there was no fog and the sky was clear. We heaved a sigh of relief as the plane taxied to the edge of the runway and waited for flight clearance.

Suddenly, to our dismay, the plane turned around and taxied back. Conditions at Kirensk, the first of the two stops we had to make, were too poor for landing. We had to wait for clearance from Kirensk. It was a long hour's wait before we were back at the runway and lifted off this time above the sunlit hills; below them, the fog shrouded the river and its city.

CHAPTER X

Socialist Rebirth

Kirensk is one of the scores of settlements established along the Lena by pioneer settlers who found this river artery running from the heart of a continent a good place to live, despite climate and distance. Here they could grow their crops, hunt and fish, and by the beginning of the eighteenth century, while Toronto was still a small French trading post, 164 peasant households were farming in the Lena valley, distributed over the Ilim, Vitim, Aldan and Kirenga regions—regions that now yield mineral resources far richer than the mica found on the Aldan River that they used for their windows.

For the site of Kirensk in 1631 they chose a broad tongue of land thrust out into the river from a narrow throat. Long ago the throat was severed by the erosive action of the water and now the river is unimpeded in its majestic sweep around the town on its island. My interest in Kirensk, however, was more than an appreciation of its setting.

Across the mountains to the east lay the Vitim River and Bodaibo, the Lena gold-mining centre. As a one-time placer gold miner, I am nostalgically drawn to gold-mining operations anywhere and I would have liked to see the goldfields, as much for their history as for their operations. I had no doubt that the operations would be modern and highly mechanized, far removed from the small operations I had known half a century ago in the Atlin-Yukon area, walking 30 to 40 kilometres a day to open and close the dam, fixing flumes in the hills and working with a rock-hook under the spray of the monitors to keep the sluicebox clear.

The work was hard, the conditions primitive and the price and credit structure that kept the miners perpetually in debt to the

private storekeepers was essentially the same, but all of it paled beside the conditions in the Lena goldfields that precipitated the great strike of 1912.

Gold mining on the Olekma and Vitim rivers in the Lena basin started in 1846 and by 1889 some 12,000 men and 11,000 women were employed in the goldfields, with Bodaibo at the centre. As foreign capital reached out for the mineral resources of Siberia after completion of the Trans-Siberian Railway, a British company, Lena Goldfields, was formed in 1908 to acquire 70 percent of the shares of Lena Gold-Mining Company (Lensoto), the biggest Russian company operating in the goldfields—the operations on the Lena and Yenisei accounted for 70 percent of Russia's gold production.

The British company's reports told their own story. At its first annual meeting in London in 1909, it reported production of 694 poods of gold—11.1 metric tons—and noted with satisfaction that "this was not only the largest output of any individual gold-mining company in Russia, but showed a result unparalleled in the annals of alluvial gold mining." Shareholders received a total dividend of 20 percent. The workers who produced this wealth did not even get their meagre wages in cash.

In March 1912 thousands of them went on strike, demanding shorter hours, higher wages, abolition of the notorious truck system, adequate medical services and separate quarters for married workers—the company made a practice of sending husbands and wives to operations far apart.

The conditions against which they struck were well described by the staid conservative London *Economist* in its issue of May 18, 1912:

"...The remoteness of the spot makes the workmen a good deal more dependent upon the goodwill of their employers than in other districts, for there is no alternative employment; and dismissal, in the winter at any rate, is said to be almost equivalent to a sentence of death from hunger and cold. The company owns all the houses and the canteens, as well as the only line of railway.

"It is alleged that taking advantage of these circumstances, the company combined all the worst abuses of the truck system with very bad accommodation, low wages, frequent fines, and

excessively long hours. Wages, we are told, have never been paid in cash; the food is dear, of bad quality, often mouldy and putrid; wooden barracks in which the work people are lodged are inadequate, insanitary, damp in the hot season and freezing in the winter. Work has to be carried on in ice-cold water in insufficient clothes, and clothing can only be purchased from the company at exorbitant prices..."

The company rejected the strikers' demands and police arrested the strike committee, although the strike had been peaceful. The march organized by the strikers to petition for release of their committee members was just as peaceful. But the marchers were intercepted by a company of troops who opened fire on them, killing 270 and wounding another 250.

News of the massacre aroused a storm throughout the country. Workers went out on protest strikes in many cities, including 100,000 in St Petersburg, culminating in huge demonstrations on May 1, a prelude to the greater storm to come.

Lena Goldfields, in its interim report to shareholders in February 1913, absolved itself with the comment: "The English company which owns most of the capital has nothing whatever to do with the management, and no direct responsibility for the conditions which produced the strike." And in its annual report in December that year it complained:

"...The men struck work, and while they were idle not only were all the general charges continuing, but had to be increased very heavily for the purpose of getting extra police force. It is true the men did not get any wages from the company, but they had to be fed and housed at the company's expense, and when the strike was over they and their families had to be removed to Irkutsk, which is 1,200 miles from the mine.

"The poor results of the year 1912-13 may be fairly attributed to a considerable extent to the strike. With very few exceptions, all the men who had been on strike left the mine, so that the management had to begin work, not only with a reduced staff, but with men who had no experience of mining and were new to the country..."

Nothing in the company's subsequent reports indicates that anything was done to improve the conditions. Proposals were made for increasing the profitability of operations by introduc-

ing methods "more in accordance with those which have been evolved, after much experience, in the Klondike, where the climatic and geological conditions are very similar", and the first of the new dredges was built in the U. S. As the war generated its revolutionary climax, however, the company's reports were dominated by differences between the Lena Goldfields and Lensoto companies, in fighting among the directors and offers for acquisition, "all of which . . . were inspired by Americans".

At the company's annual meeting on June 14, 1919, its chairman, Lord Harris, expressed the hope that Kolchak would understand "the greatest importance to the Siberian government that Lenskoye gold should be produced in the greatest quantity possible", refusing to credit a report that whiteguard forces had been driven from the goldfields. "The intimation in yesterday's papers that a Bolshevik force had seized the minefield is most discouraging," he said, "but in the absence of confirmatory advice, I decline to accept the statement as an established fact."

Kolchak, his armies disintegrating under the blows of the advancing Red forces, was in no position to uphold the company's ownership of the Lena goldfields and eventually the company's worst fears were realized—the goldfields were taken over by the socialist government brought to power by the workers who produced the wealth.

It is ironic that in a country so rich in gold resources, one of the exiled Decembrists, Prince Evgeny Obolensky, should have deplored the abolishment of Russia's Ross colony in California in 1841 because, as he wrote in his memoirs, "This colony, which we handed over to the North Americans, might have been a firm foothold enabling us to participate in the exploiting of the gold-fields which afterward became so celebrated." California's gold creeks were soon exhausted; the Lena goldfields are still producing.

Yakutia is rich in gold too, almost all of it recovered from gold-bearing sands. It has its diamond pipes in the Vilyui area. It has its tin at Ust-Yansk where the ore is so rich that it justifies the high cost of a mining operation on the Arctic coast. And in the south, it has its coal, billions of tons of it, as the foundation for the planned steel complex which, with eventual exten-

sion of the railway to Yakutsk, will have a profound effect on the republic's future.

Nowhere perhaps are the changes brought about in the decades since the revolution more apparent than in Yakutia.

When Pyotr Beketov, the Cossack who founded Yakutsk in 1632, made his way down the river, the Yakut people he found there were themselves relative newcomers to the territory, at the end of a long migration from their original homeland around Lake Baikal under pressure from the Mongol hordes. Like the native peoples of Canada in their migrations, the Yakuts preserve the story of their migration in legend, and their ancient Turkic language with its admixture of Mongol words provides ethnologists with clues, but there are no written records to show when the retreat northward began or how long it lasted. With them they brought their horses and cattle to become the only stock-breeding people in the Siberian north.

Beketov recorded the founding of the Yakutsk *ostrog* in his report to Tsar Mikhail Fyodorovich. Writing in the obsequious style of the times, he said:

"...And in the spring of that year, Sire, when the ice went out I, your slave, and the service people sailed down the great river Lena, and having arrived at the Yakut lands, built an *ostrog*, and made all the necessary defences for the *ostrog*.

"And at Yakutsky Ostrog I, your slave, spent a year with the service people, and for your royal contentment brought under your exalted rule many Yakut princelings and their villagers ... and for you, righteous Sire, collected much fur tribute from the Yakut lands and Uzhiganekh, and from the Tungus on the surrounding streams..."

The Tungus were the Evenks, who now have their own national area in the Krasnoyarsk Region, although as Khristofor Grigoriev, of the Department of Northern Peoples, told me when I met him in Yakutsk, more Evenks now live in Yakutia than in the Krasnoyarsk Region.

Ruthless exploitation in the fur trade, the ravages of smallpox and depopulation of entire areas during frequent famines rather than bloody extermination marked the course of tsarist rule in what Beketov called the Yakut lands, although there were exceptions. Pyotr Golovin, the first *voyevoda* of Yakutsk, was

barbaric in his repression of the Yakuts, having them mutilated, blinded, hanged from their ribs and buried alive after his cruel treatment goaded them to revolt. At the same time, he imprisoned his own deputy, his secretary and 100 other Russians whom he accused of inciting the Yakuts against him.

The Russian governors needed the natives in order to exact *yasak*. And along the Lena south of Yakutsk where the Yakuts followed a more settled way of life as stockbreeders, the differences between the Yakuts and the new Russian settlers were overshadowed by their common need to extract their living from a land where good harvests were few. Grain crops were planted, but the very uncertainty of the harvest made cattle—and land on which to graze them and grow hay—important to all.

Cossacks, peasant exiles and later freed serfs swelled the old settlements and founded new ones in Yakutia. Political exiles sent to live among them left their imprint. The Decembrist Matvei Muravyov-Apostol was exiled there and so was Nikolai Chernyshevsky, whom Karl Marx, in a letter sent from London in 1877 to the editor of *Otechestvenniye zapiski*, called “a great scholar and critic”. Sergo Ordjonikidze, who became the first commissar (minister) of heavy industry, was in exile in a small settlement south of Yakutsk in 1917 when the revolution took him back to Petrograd.

The exiles also included members of religious groups—the Old Believers, whose fanatical opposition to revision of liturgical books brought them into conflict with the tsars, and the Skoptsy, who believed castration was essential to salvation. The Old Believers founded one village, Pavlovskoye, near Yakutsk. The Skoptsy, exiled by Catherine the Great, established 11 settlements, the largest of them Markinskoye in the Yakutsk area.

The Doukhobors were the last of the exiled religious groups to arrive in Siberia, establishing three villages around Yakutsk in 1897. Acknowledging no government authority and rejecting orthodox religious organization—the word Doukhobor, originally a derisive term, means “spirit fighter”—the Doukhobors were exiled first to the Crimea and then to the Caucasus. There divisions arising from differences over communal and private property and leadership of the sect prompted one wing to seek permission to emigrate.

Canada, eager for new immigrants to open up its prairies, agreed to take the Doukhobors, promising to respect their religious beliefs and their refusal to bear arms. In 1898 Leo Tolstoy assisted the advance group to go to Canada. The following year close to 7,500 Doukhobors arrived to take up land grants in Saskatchewan, where the men worked in railway construction camps while the women, hitching themselves to plows in groups because they had no horses, broke the sod for the first crops. But the rifts persisted and within ten years nearly 6,000 of them moved to a new communal settlement in British Columbia with their leader, Pyotr Verigin.

The newly founded settlements in Yakutia felt the effect of the mass emigration to Canada, for it deprived them of the anticipated influx of adherents.

No matter what their origin, the newcomers to Yakutia found themselves bound by the restrictions of the established order which ground down peasants and natives alike. After close to three centuries of tsarist rule, the revolution broke on a territory that remained remote and backward, holding no more promise for its native peoples than a continuation of the ruthless exploitation and privations of the past, the illiteracy that kept them in ignorance and the diseases that destroyed them physically.

The promise of a new order was heralded by Yemelyan Yaroslavsky, the writer exiled to Yakutia as a Bolshevik who became Lenin's first biographer and now lies buried in the Kremlin wall. After the February Revolution of 1917 which overthrew the tsarist government, in his message to the first congress of Yakuts and peasants held in April 1917, he declared:

"We are convinced that the Yakut people will employ their new-found freedom to develop with all their strength a friendly, fraternal union with the peoples of Russia. From now on the Yakut is not an alien; from henceforth he is a free citizen."

Before the Yakut people could exercise their new freedom, they had to secure and defend it. In the Civil War the strategic location of Yakutsk on the Lena made it an objective for the white forces which in August 1918 seized control of the city with the aid of counter-revolutionary groups, in-

cluding hereditary Yakut chiefs who held privileged positions under the tsarist regime and benefitted from the exploitation of their own people.

Soviet supporters in Yakutsk, who had established their own Soviet of Workers' and Soldiers' Deputies in 1917, maintained their underground organization and on December 14, 1919 they rose against the Kolchak's whiteguards and regained control of the city.

In 1922 the Yakut Autonomous Soviet Socialist Republic was founded. And in the six decades since, not only have the Yakuts held free and equal rights in a socialist society, the material conditions have been created to enable them to take their place at every administrative, scientific, educational and industrial level, however technologically advanced, of that society.

"We had no roads before the revolution, no medical services for the people, no educational facilities except for a few church schools—perhaps there were ten of them," Tommot Sivtsev, chairman of the Yakutia planning committee and himself a Yakut, remarked one day as we sat in his office discussing everything from education to permafrost.

"Now we have 565 general schools, about 40 vocational and technical secondary schools, and Yakutsk University with nine faculties. We also have our Yakutsk filial of the Siberian branch of the Academy of Sciences, which includes some institutes not found anywhere else in the country, like the Institute of Physical-Technical Problems of the North.

"How do we ensure that Yakuts and other native peoples are given full opportunity to advance to the limit of their ability in whatever field they may choose? Sometimes it's pretty hard to get away from figures. They are the only comprehensive measure of our achievement, how far we have come in so short a space of time.

"In 1917 the population of Yakutia was 264,000, of whom 80,000 were Yakuts. Now the population is 879,000, of whom 370,000 are Yakuts, nearly one in every three. We have more than 6,000 students at our university and 5,000 of them are of native origin. The majority are Yakuts, Evenks, Evens, Chukchis and Yukaghirs, the smaller native peoples. And then there



Yakutsk. A new nine-storey dwelling house on permafrost



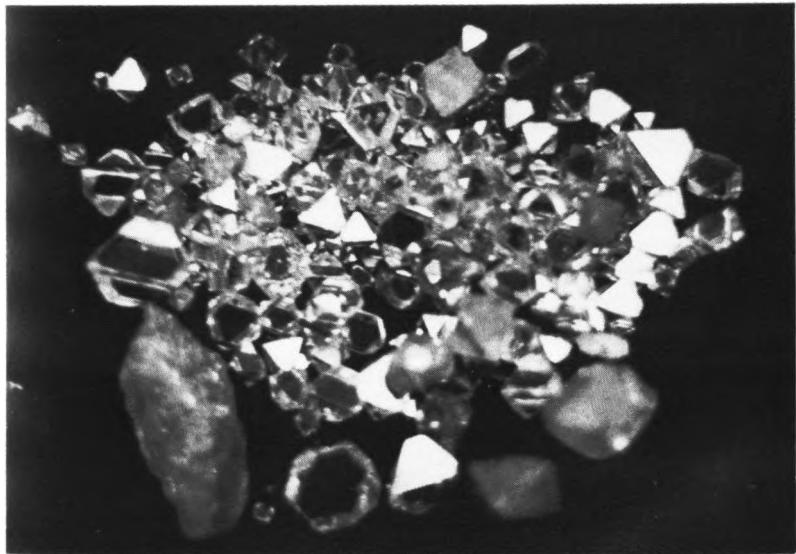
Pilings driven into the frozen ground—the foundation for modern houses in the permafrost area



The road to Yakutsk coal is open. Laying the last section of rails to the coal colliery



In the quarry of the Mir diamond pipe



Yakutsk diamonds



Engineer-geologist Vasily Gotovtsev has worked in the Mir, Aikhal and Udachnaya diamond pipes



Meeting in Yakutia. These 120-ton heavy-duty BelAZ coal haulers work at the Neryungri coal deposit



The underground laboratory of the Permafrost Institute



Many nationalities live in Yakutia. These young girls—an Evenk and a Russian—go to the same school



The first form at a boarding-school in one of the reindeer-breeding settlements



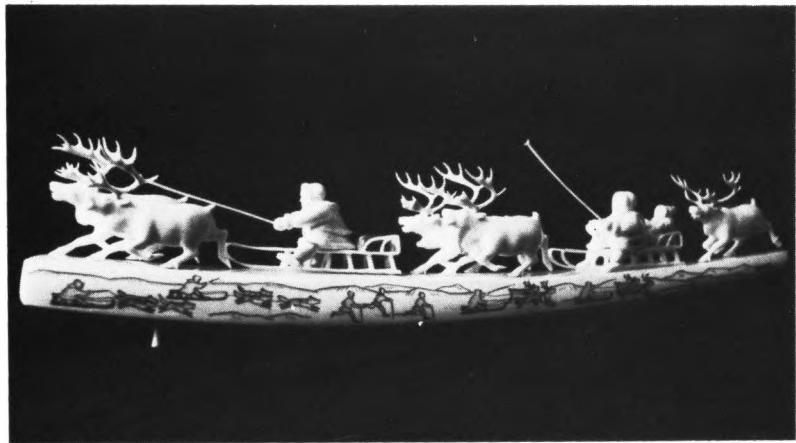
The thermometer sometimes dips to -50° Celsius in Yakutsk.
Bundled-up children head to kindergarten



Arctic Circle "cowboy"



Reindeer-breeders from a state farm on their way to a traditional festival



The art of bone-carving is widespread amongst the peoples of Siberia



A Yakut souvenir factory. High boots from the fur of reindeer paws are sewn in Yakut national designs



Yakut artists painting from life



A young Yakut violinist



Playing the *khomus*, a folk instrument



Making the rounds at a village hospital

are another 19 minor peoples in all who have moved to Yakutia since the revolution."

Grigoriev, when I asked him later how the children of people still following a nomadic existence in northern areas received their education, told me about the system of state boarding-schools set up as the most practicable way of solving a problem in which strong family and community ties must be balanced with the needs of the children and their right to an education that will enable them to choose their future place in society. The children are taught in their own language and all the costs are borne by the state.

"Those who go on to higher institutes get free board and lodging, no matter where in the country they go to study, and in all the higher institutes there are special places for northern peoples," he said.

Historically, the life of Yakuts in the south has centred around their settlements, while those in the north have followed a nomadic existence—reindeer husbandry, which they acquired from the Evenks, horse-breeding, trapping, hunting and fishing.

"In the northern areas they still follow the old way of life. For that matter, so do some Russians, descendants of the pioneers, the Old Siberians," Grigoriev pointed out.

The Soviets are taking a many-sided approach to the problem of bringing the Yakuts and other northern peoples into a technologically advanced society without destroying their old ways of life, evolved over centuries and well adapted to their environment.

In the postwar years, as oil multinationals and big mining corporations have thrust their way into the north, pushing the native peoples aside, Canadians have found the same problem assailing their national conscience. At the same time as the native peoples from the Yukon to Labrador organize for recognition of their rights, they want their ability to pursue traditional ways of life secured and a share of the wealth extracted from their ancestral territories, whether the Nishga lands of northern British Columbia or the Dene lands of the Northwest Territories.

In the Soviet Union the conflict of interests that produced

these problems was swept away with the old system and the new socialist system has solved them.

The taiga and the tundra are vast and industrial development, while it has opened new opportunities to the native peoples, has impinged little on the life of those who prefer the old ways. But now the native peoples have a choice.

Education has erased illiteracy and made knowledge accessible to the remotest settlements. The skills handed down from one generation to another are reinforced by offering instruction in new hunting and fishing techniques. The old ways are strengthened by removal of the spectre of hunger and disease which accompanied them for centuries.

"We are trying to encourage the formation of larger settlements, but not so large as to restrict the traditional pursuits, between 300 and 400 people," Grigoriev told me. "This makes it easier to provide services of all kinds."

For those who prefer the traditional occupation of husbandry, state and collective farms are raising reindeer on a large scale, with all the advantages of scientific breeding to produce new strains, veterinary services and surveys of feeding areas to determine how many animals they can support. The tundra and the taiga are producing the livestock for which they are best suited—and in time the musk-ox may be added to the reindeer. Not only have the domestic herds multiplied, but so have the reindeer in the wild. The new ways have advanced the old to a far higher level, making reindeer husbandry a major livestock industry and the most important of all the traditional occupations of the north.

Similarly, although many Yakuts in the settlements keep horses for the sole purpose of making their own *kumys*, the fermented mare's milk which ranks as Yakutia's national drink, its production has been mechanized on state farms, which maintain herds of the sturdy little Yakut horses the people brought with them on their long migration north.

Custom demands, however, that *kumys* be fermented in a leather bag and beaten with a shaped round stick until it is strong and fizzy.

"That's the only way to make it," they assured me. "It's good

for you, helps healing, cures nervous diseases." But nobody offered me any.

The mining, oil and gas industries are penetrating Siberia's northern areas, just as they are invading the Canadian north. While their traditional pursuits are protected and advanced, the native peoples of Siberia can only take their full place in this industrial development if they produce the men and women with the requisite qualifications—geographers, geologists and metallurgists, engineers and technicians, drivers and mechanics . . . the list lengthens with every new advance in technology.

This has long been the objective of education in Yakutia in planning for a future so rapidly taking shape, and I only had to note the number of Yakuts. Evenks and others among the administrators, scientists, writers and artists, as well as those working at various jobs in industry, to know that the objective has become the reality.

"Do you know what my name means translated into Russian?" Sivtsev asked me with a broad smile when we were discussing how Soviet scientists cope with permafrost. "It means 'not freezing.'

"Well, we haven't been able to alter the climate yet, but we no longer look on permafrost as our enemy. Now we have learned how to work with it, permafrost is our friend. We have even learned how to erect five-storey buildings on it.

"Permafrost is useful in agriculture too, mainly in the central areas, for growing wheat and potatoes. The topmost layers thaw, releasing moisture which is essential to successful crop production in arid areas where there is little rainfall in our short summer. So we have learned how to make it grow things for us."

To the northern peoples of the Soviet Union, as to the northern peoples of Canada, the Arctic and sub-Arctic regions have always been friendly—stern, forbidding, but hostile only to those who refused to accept the conditions they imposed. Their cultures used the living resources of the regions to the full, for clothing, housing, weapons, utensils and transportation, and they used snow and ice to their advantage. Their limitations were those set by the level of their cultures.

The European settlers who followed them brought their

own culture and adapted it, both giving to the native peoples and acquiring from them what was useful.

John Ledyard, writing from Yakutsk in 1788 to his cousin Isaac Ledyard in New York, reported:

"...There are no wells at Yakutsk; by experiment they freeze 60 feet deep. People of these regions are therefore obliged to use ice or snow: they have also ice windows; glass is of no use to the few who have it. The difference of the state of the air within and without is so great that they are covered on the inside with several inches of ice and in that state are less luminous than ice..."

Now the barriers to education have been removed and scientists from the northern peoples are working side by side with scientists from the European republics in building in permafrost and extracting the minerals, oil and gas frozen within it. By learning how to preserve it, they have found how it can be adapted to their use, supporting development and yielding its wealth without bequeathing a legacy of destruction to future generations.

The research being done at Yakutsk's two institutes for the study of permafrost and the effects of cold has earned them an international reputation and relations between the Soviet scientists and their Canadian counterparts are good.

"In 1972, when the second international conference on permafrost was held here, 42 Canadian scientists attended," Prof Evgeny Katasonov informed me. "Canadian studies of the Beaufort Sea have contributed to our understanding of permafrost beneath the sea bottom and I'm sure our studies have contributed to Canadian knowledge of permafrost because we maintain contact with several Canadian universities."

A geology professor at the Institute for Permafrost Research, one of the many institutes maintained by the Siberian branch of the Academy of Sciences, he obviously was well informed about Canada because he made frequent allusions to Canadian similarities and differences in explaining the institute's work.

"The work we do is very important because it makes it possible to master the problems of building in the north, extracting its resources and enabling people to live and work here—and our north, like your own, is a huge area.

"Here around Yakutsk the permafrost is 300 to 400 metres deep. But the depth is irregular. There are abrupt changes. Beneath us here at the institute it goes down 300 metres. But 20 kilometres from here it may go down 600 metres. The greatest depth is in western Yakutia where it goes down 1,000 metres.

"Since somewhere around 45 percent of the area of the Soviet Union is affected by permafrost, you can see how important our work is.

"There's no permafrost below large rivers and lakes, but there are bulbs of permafrost beneath shallow rivers and lakes. In some places the ground is composed of pure ice, 60 or more metres across. And often the ground includes small layers of ice—the ice content may be anywhere up to 80 percent. This is where we encounter our biggest problems in construction.

"The reason the northern plains of Yakutia aren't as well developed as the lower reaches of the Lena and other rivers is that they have large areas of ground ice, although we also have problems with ground ice in the southern areas. There we find islands of it in some places as well as permafrost four metres below the surface.

"Construction engineers submit their problems to us and we try to find the answers, whether it's building a pipeline, a dam, a road or a railway. Often the problems can be anticipated because we have been working in our northern areas for a long time. Sometimes, though, new problems arise in the course of construction and the answers can't wait.

"We know a lot about permafrost now. We have studied its evolution and mapped the ice content from area to area. From our research and experience, we have acquired a great deal of knowledge about different types of construction. Our researchers use computers to build models simulating freezing and thawing effects for construction engineers working on particular projects so that they know what to expect and we can seek solutions.

"In Canada you are more fortunate in one respect. You have the huge area underlain by the Canadian Shield, which comes closer to the surface and provides a more solid footing in permafrost areas. Our permafrost goes deep."

The problems of building in permafrost are equalled by those of devising equipment capable of operating in temperatures

which, in a winter that lasts from six to eight months, can fall to minus 70 degrees Celsius, with a mean January average of minus 43 degrees. At such temperatures steel becomes brittle and equipment breaks or fails.

The Institute of Physical-Technical Problems of the North was founded in 1970 to find solutions to these problems. The range of its responsibilities is formidable. It is charged with investigating the resistance to sub-zero temperatures of all machinery and equipment used in construction, transport and mining. Developing new cold-resistant metal alloys and more durable polymer materials, extending their life and determining how long they will stand up under extreme cold are all within its sphere of research. It also is responsible for research into various fields of energy resources, including the formation of gas hydrates and methods of utilizing them.

When Vladimir Larionov, the institute's deputy director and chief of its welding laboratory, asked me what I was interested in learning, it was difficult to know where to start. I did not ask him his national origin—he might have been Kwakiutl, Tlingit or any one of the Native Indian peoples on the British Columbia coast. After two days in Yakutsk, where people of all Soviet nationalities mingle everywhere, it did not matter. The information might be volunteered as a point of national pride but never of prejudice.

Softly spoken and a little reserved, he pulled some photographs out of a folder. "These will show you some of our problems," he said.

The photographs showed crumpled crane beams, snapped truck axles, broken pipe, some of it Soviet-made by its markings and some of it imported from other countries.

"If all our Soviet equipment stood up as well as we would like it to, we would have fewer problems," he declared. "Some of it does fail, usually when it has not been designed to operate under the extreme cold of the north. On the other hand, when it's manufactured according to recommendations made by our researchers, substituting new materials we have produced for conventional materials, it's usually quite durable."

"We've had some unfortunate experiences with foreign equipment. For instance, we got a number of Lectra Haul N200 ore

carriers at \$ 1.5 million each from a manufacturer at Tulsa, Oklahoma. We had so many breakdowns with them under our extreme cold conditions that it cost the U. S. company \$ 5 million in replacing parts. As a result of this experience, the company changed its technology. Breakdowns, particularly if they delay a project, can be very costly for us too."

Siberia and the Yukon share the dubious distinction of having experienced record low temperatures in the two coldest places in the northern hemisphere—minus 73 degrees Celsius at Oimyakon in 1922 and minus 49 degrees Celsius at Snag in 1947. Only outer space is colder, and it crossed my mind that research into the effects of cold on earth can be applied to outer space. But I phrased my question about the institute's research in a general way.

"We're experimenting with new alloys, different combinations of carbon, nickel and manganese. And we're experimenting with different kinds of plastics," Larionov replied. "But one immediate experiment we're engaged in is with building materials.

"The methods we use in our space program are too costly for large-scale use in the north. One of our aims is to lower building costs, so we're looking for alternatives to traditional materials like concrete and brick by experimenting with the use of plastics and various wood compounds. Wood was our building material for centuries, it is abundant, and modern technology has opened up all kinds of possibilities for its use."

Aware that the Soviet Union and Canada lead the world in gas hydrate research and that the U. S. is embarked on an expanded program to find a way to extract and use the gas, I asked him about it.

"We've done a lot of research into gas hydrates," he said. "It was one of our major achievements when Prof Nikolai Chersky, a former director of this institute, and a research team proved that natural gas exists in a frozen state in crystal hydrate form, like snow, under certain areas of permafrost. There are, in fact, far greater quantities of gas hydrates than gas in a liquid state. Sea bottoms are particularly favorable areas for deposits. But gas hydrates are unstable and the problem is to find a process for extracting the gas.

"As you know, Yakutsk already is heated by a gas pipeline from the Vilyui natural gas deposits, which are estimated at 13,000 billion cubic metres, so it's not an acute problem here."

Not only has Yakutsk solved its heating problem, it has solved its water and sewage problems as a result of the research done in its institutes—gas, water and sewage pipes are laid together in spacious tunnels built deep underground.

Yakutsk as a city is itself material proof of what the years of research have accomplished.

Little remains of the old wooden city. A few of the houses have been preserved, but most of the city has been rebuilt in recent years. In the large open space—and Yakutsk has many of them—behind the museum a wooden gate-tower stands rather forlornly, the larch logs laid two storeys high as sound as when it was built. It is all that is left of the fort erected three centuries ago by the Cossacks. Even here, at the far end of the wilderness, the builders added their ornamentation, for each plank in the steep roof is carved at the end to form a frieze running around the tower.

The new city is spacious and clean, almost crisp under the clear sky and wan sunshine of the sub-Arctic fall. In the paved squares at the city's centre marigolds still struggled into bloom, but in the unpaved open spaces farther out the grass was sere and yellow and along the river the chill wind rustled among the withered reeds and seed-heavy grasses.

The white five-storey apartment houses with their colored balconies almost sparkled in the crystal air. The concrete piles on which they stood, driven deep into the rock-hard permafrost beyond the reach of summer thaw, were covered by skirting boards below which air space exposed the footings. A metre above the footings, the apartment floors started, sometimes three storeys, usually five storeys and occasionally even higher. Except that these were modern apartment buildings elevated to prevent the heat from melting the permafrost, they reminded me of the early houses built in British Columbia's coastal rain forest, raised on cedar piles to prevent dampness from rotting their floors.

"All our buildings in Yakutsk and Mirny are built on these

'made in place' concrete piles," Prof Katasonov had told me. "The upper layer of the permafrost thaws to varying degrees, from a few centimetres to three or four metres, depending on the type of ground. The footings are placed well below the thaw level. In some instances, we use gasoline to protect them because it takes warmth from the ground and preserves the permafrost."

Around Yakutsk stretches what is known as the Velikaya Tuimada, an area some 60 kilometres long and 30 kilometres wide beyond which lie its protective mountains, Svyashchennaya and Kangalasskaya. Like Alaska's Tanana River valley, it is a fertile area, producing good grain and vegetable crops under the long summer sunlight, despite Yakutsk's average 95 frost-free days and the short growing season.

The city's industrial heart is in its port, serving the Middle Lena fleet and as busy as any seaport with its giant cranes and container docks, although as the river flows, it is 1,500 kilometres from the Laptev Sea in the Arctic. At Yakutsk, spaced by its islands, the Lena's valley is 25 kilometres wide. At its Arctic delta where, like Canada's Mackenzie River, it spreads into channels, it is 120 kilometres wide.

Sixteen kilometres downstream from Yakutsk lies the newer settlement of Zhatai where the Middle Lena fleet has its base and a shipyard turns out self-propelled steel river barges.

Until the expected expansion of industry in the nineties, these are Yakutsk's main industries. But the city has one unique industry, derived from Yakut culture, which employs hundreds of native workers, the majority of whom are Yakuts. Its products can be found in stores throughout the Soviet Union, side by side with equally unique products from all the republics. None is more popular with tourists than the bone carvings, fur hats and reindeer-hide garments from Yakutsk.

Canada has its own internationally known native carvings, its argillite totem poles and boxes carved by the Haidas in the Queen Charlotte Islands who have sole right to the one known argillite deposit, and its Inuit soapstone carvings, now grown from pieces small enough to be carried in the hand by hunters constantly on the move to large sizes better suited to display by those who can afford the high prices. But souvenir stores are

full of factory-made copies of authentic carvings produced from plastics and synthetic stone.

The products of the Sardaana souvenir plant in Yakutsk are authentic in that they are made of the traditional materials and finished by hand. In the shop where boots—the Yakut *unty*—and vests are made, I saw women seated at a battery of sewing machines and the material they were working on was reindeer and horse hide. But in another shop the finishing work and final stitching was being done carefully by hand. The one concession the plant makes to modern materials is in the use of synthetic fur for hats and trim.

The Yakuts have no tradition of carving in stone. Their materials are bone, cattle horn and wood, from which they make their *kumys* holders, produced by the Sardaana plant in various sizes and colors. The bone they use for carving their pieces in conventional themes—dogs pulling a sled, dogs hunting a bear, men herding reindeer—is sperm whale. But for carving in mammoth ivory, the material in which the Yakuts and other native peoples have worked for generations, I had to go to one of the master carvers whose finest work is acquired by museums. They too command as high a price for their work as any Haida carver.

That is how I came to visit Stepan Petrov in his apartment.

"It is an honor to show my work to a Canadian," he declared as he ushered me into his living room while his wife rubbed a cloth once more over an already well polished table. My attention, however, was not on the table but on the mammoth carved from mammoth ivory at its centre. Petrov followed my gaze.

"Pick it up," he commanded. "That is one of my best works. It took me two, closer to three months to carve."

I turned the cream colored carving in my hand. It was heavy and the finish had the feel of silk.

"I take my raw material and I look at it," he said. "I think a lot and I pace up and down trying to imagine my finished work and how I will bring it out of that piece of mammoth tusk. Then I begin work. Come, I'll show you."

He took me into a small anteroom. "See, these are my tools." He indicated a small wheel and an assortment of tools on the

table beside it. "I work here maybe two hours a day. The rest of the time my mind is concentrated on the piece of ivory because what comes out must be alive."

When we returned to the living room his wife had set out a number of carvings. One was unfinished and he picked it up to show me. It was a large piece of tusk cut lengthwise on which the outlined figures already were taking shape.

"This is what I am working on now," he explained, "but it will take a long time to finish. I have chosen a name for it, 'Victory Will Come'. Museums buy my best work and I hope this will be good enough for a museum."

I asked him what decided him to become a carver.

"I'm continuing a family tradition. My father was a wood-carver and I became interested when I was about 20. I started carving in wood and I still carve in wood, but I prefer ivory because it is dense and takes such a smooth finish." His hand caressed the carved mammoth.

I thought of the sculptured mammoth standing at the entrance to the Institute of Permafrost Research. Siberia was the last refuge of the woolly mammoth retreating in the wake of melting glaciers and the evidence is strong that its extinction was hastened by early man. Yet it lingers as a symbol of Yakutia, whose Evenk people retain in their legends convincing descriptions of the mammoth and its habits as if in fact their ancestors had taken them from life. What they took from death were the tusks they used for the framework of their shelters and now, the ivory carvings that are giving new life to their art.

As a free artist, Petrov can sell his work to any buyer. I asked him what prices he got.

"It depends on the work," he replied. "I ask at least 600 roubles for any piece, but much more for the larger pieces."

Before I left I bought a piece of his work, a carved moose, in a transaction negotiated by Lyalya and while it was not a gift, at the price I paid him I considered it as such.

To the Yakuts and other northern peoples, socialism has brought a flowering of their art—their carving, their music, their painting and their literature. Not only have they plumbed their myths and their legends, but they have produced novels, poetry and plays, for which their artists create some of the most

original and imaginative stage settings in the country. Their music embraces the same broad range, from the *olonkhosuts*, masters of mimicry, who use their voices to imitate such sounds as running water and wind in performing the *olonkho*, their national folk epic, to the singers in their rock bands, who draw on the songs of other nationalities but also write their own.

At the hotel one night the band leader sent a message to me. What did I think of their band? How did it compare with bands I had heard in other cities? They had not been playing together all that long, but they were working hard at their music and they wanted to be among the best. They did have talent and in time they might be.

I got an insight into the work Yakut artists are doing when we dropped into their studios and ended up seated around a cleared table drinking tea and eating cranberries while we talked about their work, mostly the engravings, wood and line prints which seem to be their favored medium, and their views on art.

Those who try to draw a disparaging difference between dull "official" Soviet art and bright "private" art should first take a look at some of the mindless exhibits masquerading as art in their own galleries—"official" art without popular appeal, but sold at high prices and therefore to be protected as an investment.

"We want our work to be seen and appreciated by people. We want it to be part of their lives, which implies that it has to have meaning for them. After that, it is a question of talent. We create what we want. People will accept or reject it. What appeals to one may not appeal to another. The more people know about art, the more critical they are and we listen to their criticism."

It was a discussion frequently interrupted as first one and then another went rummaging through piles of prints to find samples of their work, but that is a summary of what they told me.

Two of the artists whose work particularly interested me represented widely different concepts. Vladimir Ivanov, a young artist, has developed a distinctive style in traditional themes.

"I can't show you much of my work," he said apologetically.

"Most of it is out on exhibit. But this is one I'm just finishing."

He pointed to an easel. Across the bottom of the white expanse dogs and men struggled and strained against the wind. It was a simple drawing, yet I could almost feel the vast loneliness of the Arctic that it conveyed.

Afanasy Munkalov is an older man. From the sheaf of prints he handed me, I returned again and again to one in particular. It too incorporated traditional themes woven into a powerful symbolism—the native woman huddled over her child, a native man holding aloft the rock to dam the river, another holding aloft the sun of nuclear power, satellites and snowflakes. Dull, too political? This was symbolism that every Yakut could understand—and it was art as evocative in its way as Picasso's *Gernica*.

Munkalov presented it to me after inscribing it, "Peace to the writers of the world."

In lifting the smaller peoples of the north, like the Dolgans and Yukaghirs, from the brink of extinction, socialism also has retrieved their cultures and restored their national pride. It has given them alphabets to record their songs and their history and a literary voice far stronger than their numbers. Written in their native languages and translated into Russian, their work is read across the country.

In Novosibirsk, Anatoly Nikulkov, the editor of *Siberian Lights*, had told me that about one third of his contributors were from the native peoples, writing in their own languages.

"We translate their work into Russian, even though most of them can write in Russian," he had said. "They prefer to write in their own languages. I remember one writer telling me, 'I can think in Russian, but I write in my own language.' They don't even like to translate their own work into Russian. They would much sooner have somebody else do it."

My stay in Yakutsk was in the hands of Yegor Sibiryakov, a Yakut and chief editor of the Yakutsk book-publishing house. An energetic little man, he would appear suddenly in the hotel, hold a brief conversation with Lyalya in his quiet spoken way and disappear again before I could ask him anything, so that I never was sure where we were going next. I could only question him in the car when we were on our way there. What I

learned was gleaned in the course of several such question and answer periods on the road.

"How many titles do you publish a year?"

"Between 170 and 180."

"All by Yakut writers?"

"No, the majority are translations into Yakut from Russian and other languages."

"How many of the books are by Yakut writers?"

"It varies. Perhaps about 40 or 50—fiction, history, folklore, poetry and drama. Some Yakut writers also are translated into Russian."

"How many members does your Writers' Union have?"

"We have 56 members. One of them is a Russian, another is a Byelorussian, and the rest are from the native peoples. The Yukaghir have three writers, although they number only a few hundred people. They speak a Paleosiberian language which has similarities with some of your Indian languages in North America."

"And what publications does the Writers' Union have?"

"They have their own literary journal, published in two languages, our own Yakut language and Russian."

I did not have to ask him about readers. From what I saw, on the street, in bookstores, in homes, the Yakuts have become avid readers too.

The people's confidence in their future is unbounded, natives, Old Siberians and New Siberians alike.

"When BAM is completed in 1984, branch lines will be built," Sivtsev declared when he said goodbye to me. "Somewhat later the railway will reach our city. Now we're completely dependent on river transportation and the navigation season is short. Once the railway is built, we'll be part of a country-wide transportation system and no longer so vulnerable to the caprices of the weather."

Sivtsev looks forward to the train. I would sooner go by boat.

CHAPTER XI

Dam in the Permafrost

From Yakutsk it is a two-hour flight west to Mirny. Almost equidistant between them is Vilyuisk which, in the years 1872-83 when Chernyshevsky lived in exile there, was a settlement of some 450 people. And, as he wrote at the time:

"Here in this tiny town, of course, the shops have nothing but goods suited to the pockets of the common people. But people here are so used to travelling endless distances that Yakutsk, which is 700 versts away, seems to them a town you could reach out and touch. So, if anyone has the least little bit of money to spend, he buys everything in Yakutsk—a week and a half's journey away. People are constantly longing to go there."

Soviet people think no more of travelling vast distances than Canadians do, although the distances generally are greater and the flights longer. Air travel has shrunk weeks to hours and from Mirny people can reach out and touch Yakutsk in winged comfort. These days the stores in Mirny are as well stocked as those in Yakutsk, but there are always reasons for travelling between the two centres.

We were up before dawn to catch the flight and every seat was full, workers returning from leave, young people, older people, entire families, and all loaded down with an incredible number of bags and parcels.

We were no longer travelling light ourselves. Determined not to be encumbered with baggage, I had limited myself to one large suitcase and a duffle bag when we left Moscow. By the time we were ready to leave Novosibirsk, I had been presented with so many books that I either had to dispose of them or my clothes. I mailed the books to Moscow. I was not prepared, however, to entrust the box of Siberian rock samples presented to me by the Siberian Academy of Medical Sciences to the

Soviet postal system, an attitude engendered by unfortunate experiences with the Canadian postal system, which once was considered to be among the world's best. I was doing the Soviet postal system an injustice. The books got to Moscow before I did and in excellent condition. But with the box of rocks, the Georgian pottery given to me at Niya and the books I had accumulated since we left Novosibirsk, I began to think I might yet need one of those little Yakut horses.

To emerge abruptly from the clouds upon the desolate area around Mirny is enough to dismay any environmentalist. The wounds inflicted on the taiga in the first urgent exploitation of the diamond deposits are painfully apparent in the blackened trees and churned surface more than a decade later.

By comparison with the devastation caused to the taiga by the great Tunguska comet blast in 1908, the wounds are mere scratches. But these wounds were caused by men and, in a broader sense, they are part of the continuous attempts from the West to injure and cripple the Soviet Union from the hour of its birth.

Had the DeBeers mining syndicate not denied the Soviet Union the diamonds essential to modern industrial technology in order to impede its development, the need for Siberian diamonds might have been less urgent and the fragility of the environment might have received the scientific consideration it now gets wherever a new project is to be undertaken. But as the Soviets rebuilt and developed their economy after the Second World War, the cost of buying diamonds at outrageous prices by whatever means they could obtain them made discovery of Siberia's elusive diamond source a national imperative. And once found, it had to be developed quickly.

Wherever alluvial diamonds have been found their imprisoned beauty has stirred the imagination of man. To some native peoples they were fallen stars. To the Yakuts and Evenks who found them in streams and ascribed to them magical healing powers, they were firestones. Their scattered finds excited interest among the Russians and induced searches which produced more scattered finds. Somewhere in all the wilderness of northern Siberia there must be a source. Mikhail Lomonosov, the great eighteenth-century scientist and poet, was convinced

of it. But the nineteenth century closed and the revolution triumphed without the source being found. The geological surveys initiated by the Soviet government, however, made the eventual discovery inevitable.

Poor quality alluvial diamonds also have been found in Canada, in the vicinity of the Great Lakes, but the source, if one of any importance exists, has yet to be found. The Siberian source proved to be incredibly rich.

The search was narrowed to the vicinity of the Vilyui River before the Second World War by a young Leningrad geologist, Vladimir Sobolev, who recommended intensive prospecting there. His belief that this was a diamond-bearing geological formation was upheld in 1949 by another young Leningrad geologist, Grigory Feinstein, who found diamonds in the Vilyui. And in 1954 still another Leningrad geologist, Larisa Popugayeva, led a survey party to the Vilyui to test a theory that pyropes—a variety of garnet—found in association with alluvial diamonds in the Vilyui sandbars would lead them to the source. The larger the garnets, she reasoned, the less they had been rolled by water action and the closer they should be to the source.

The source was traced to Irelakh Spring, a stream running into the Malaya Botuobiya which, with the Bolshaya Botuobiya, is a tributary of the Vilyui.

"I was with the survey party which made the discovery at Irelakh Spring," Nikolai Davydov who, as chairman of the city executive committee, is mayor of Mirny, said when he was telling me about the find. "Before I started university I worked on geological surveys and that survey party was a large one. There were about 300 of us. That find led to everything we have here."

While the find at Irelakh Spring, appropriately named Dawn after the long search, was in kimberlite, it was poor in diamonds. The search continued, but now it was confined to a smaller area. A year later success came with an abundance of riches. First Yuri Kabardin discovered the kimberlite pipe at Mir, which means Peace, and hard on his find, Vladimir Shchukin discovered the pipe at Udashny, which means Success.

In the West the report was greeted with outright disbelief and disparagement, and with apprehension by the DeBeers diamond syndicate, for its monopoly could no longer be used by the

West as an economic weapon. Some questioned the richness of the discovery, belittling its importance, just as they now question Soviet oil resources. Others contented themselves with the thought that it would take the Soviets years to devise a technology for mining diamonds from the permafrost in the remote Siberian wilderness and to master the closely guarded skills of the diamond trade. The yield from the huge Mir pit and the technology devised by the Yakutalmaz diamond enterprise has answered the detractors and silenced the doubters.

No open-cast mining operation can be called a lovely sight, except by mining engineers who can take pride in the sweeping contours of the excavated pit and the switchback pattern of the roads leading to the rim. At best, it is an impressive demonstration of the ability of modern engineering to extract the earth's idle wealth and remould the terrain as nature itself has been doing since the earth began. At worst, where the plundered excavation and disrupted earth are left for time to soften, it is an affront to nature.

The hills of grey kimberlite that line the road for some distance between Mirny airport and the city are the more startling because they are part of the bleak landscape. On the older hills vegetation is beginning the slow process of recovery. The newer hills are raw and by the time fresh growth has covered them, there will be more raw hills. So long as Mir continues to produce wealth, there will always be more raw hills. But the initial mistake has been taken to heart and nature is being remoulded.

The Mir pit is impressive. From the rim, the big excavating machines 900 metres below and the dump trucks crawling up from the bottom look like toys. The kimberlite they carry conceals a fortune in gem and industrial diamonds. At the processing plant, prosaically named Factory No. 3, the ore goes through primary and secondary crushing, sieving, gravitation, suspension and flotation—and at the end of the process are the diamonds, about one fifth of them gem quality. In fact, Mir has produced a number of extraordinarily beautiful gems, among them the 232-carat Star of Yakutia, the largest diamond yet found in Siberia.

It was pointless for me to ask if this were a profitable operation. Nor was I surprised to be told that Factory No. 3 is one

of the largest diamond-processing plants in the world. A huge multi-storeyed structure, it looms out of the plain at the edge of town, built five kilometres from the pit because that was the closest site on bedrock. Construction engineers feared that any loss from the large volume of water used by the plant would melt a foundation in permafrost.

"All the equipment in the pit and all the technology in the plant is Soviet designed," declared Nikolai Alexeyev, the indefatigable city executive member who met us at the airport, packed our bags up to a spacious apartment, whisked us off to breakfast in a small dining-room and took us on a tour of the city. "I helped to design some of the equipment myself when we were developing the Irelakh deposit and I was working there as a technologist."

Nikolai Alexeyev was a true mining man and the north had claimed him for its own. The job at Irelakh, a placer operation, was his first after he graduated as a mining engineer from the polytechnical institute at Novocherkassk, near Rostov-on-Don. After five years at Irelakh, he went to work in gold placer operations south of Irkutsk. Then, from the extreme south of Siberia he went to the extreme north, to placer gold mines near the Laptev Sea in the Arctic, eventually becoming deputy head of the Yakutia mining department.

"But Mirny was my first love," he said, "and I wanted to come back here."

Nikolai Mezentsev, our driver, had the same strong attachment to this clean-cut little town. He volunteered to go to Mirny as a truck driver in 1973. "Now I am married and I have a young family, and I think of Mirny as my home town."

It took the first convoy of tractors and trucks six weeks to reach the future site of Mirny from the Trans-Siberian Railway. Now the temporary wooden settlement is gone and in its place is a modern town, the second largest in Yakutia, with a population of some 30,000.

Like all new towns, Mirny has no history. It will mark the centenary of its incorporation as a town in the year 2057 and while most of them are young, the present citizens are not inclined to wait that long for a celebration. Instead, they celebrate street by street. Whenever the anniversary of a particular

street comes up, the people on the street mark it with a festival.

And Mirny has another distinction peculiar to new towns in the north—until recently it had no pensioners. Only now are a few of its citizens reaching the minimum age at which they qualify for a pension after 20 years' service in the north.

Since we were housed in one of the modern apartment buildings and had Alexeyev with us to question about the new buildings we saw under construction, I was able to see for myself some of the new materials, like the triple glass windows and lightweight membrane panels, being used in their assembly. The panels have a prestressed lining and are filled with mineral packing, which both reduces transportation costs and lightens the load placed on foundations and frames. Builders in Mirny are also making extensive use of aluminum tiles for facing buildings—Factory No. 3 is sheathed in aluminum, which is readily available since completion of the new aluminum plant at Bratsk.

"If you can't read the sky and you want to know which way is south, look at the buildings," Alexeyev joked. "Mirny was the first to begin building with all windows facing south."

When I met Davydov, he showed me photographs of Udachny, one of Mirny's satellite settlements built for other diamond-mining operations in the region.

"It's too bad you haven't got time to go there," he said. "See, it's a pilot residential complex with a system of closed and semi-open streets. You can go from one building to another through heated passages without ever going into the open unless you want to. You appreciate it when the temperature is minus 60 degrees.

"Udachny is an experimental settlement. What we are learning from it will be reflected in the layout of new northern settlements which are still on the drawing boards. The north has always been looked upon as a harsh place to live. If people are to work here, they should be able to live in the comfort that modern technology is capable of providing for them.

"What we are trying to determine is the kind of settlement or town best suited to northern conditions, how to use the cold to our advantage, how to use solar heat.

"You have covered and underground shopping malls in some of your cities and I believe they are very popular. Why shouldn't

that principle be applied to northern settlements where they are being designed as a complex and protection against the elements is needed most? In that way we can create our own micro-climate as we have done at Udachny. The question is how best it can be done. On that we have differences of opinion not only among ourselves but with some of our colleagues in your country."

As a Yakut himself, I asked Davydov how the native peoples adjusted to this new style of living, which for a lot of them would be as great a wrench from what they were accustomed to as for anyone from the southern republics moving to the north. Why, for instance, had I seen so few native people around Mirny as compared to Yakutsk?

"The explanation is simple," he replied. "The native peoples never lived in this region. It was too inhospitable. They have only come here to live since the town was founded and for the same reason that we are all here, because the diamond pipes are here and we must have engineers and administrators and workers in the mining operations.

"Yet without the native people who knew the taiga and guided the geologists, the search might not have been so successful nor the discoveries made so soon. A Yakut named Innokenty worked with Kabardin in the discovery of Mir. This wasn't a discovery in the old sense of one or two people prospecting an area and making a lucky strike. This was a systematic search by survey parties, a collective effort to which everyone contributed."

I remembered Robert Henderson, the Canadian who was the real discoverer of the Klondike, and George Carmack, the American who made the actual strike, and the controversy that continued beyond their deaths over their rival claims. Henderson, whom I knew well in his last years, echoed the prevalent prejudice against the Native Indians. Carmack lived among them and had a Tagish wife. Two Tagish who have come down in history as Skookum Jim and Tagish Charley accompanied him on his successful prospecting trip and Skookum Jim always maintained that it was he who made the discovery when he went down to the creek to wash a dish, but Carmack persuaded him that as an Indian he would not be recognized as the discoverer. Yet without them the discovery might not have been made so soon.

Davydov pointed out that perhaps 1,500 of the 60,000 people in the Mirny region were from the native peoples, principally Yakuts and Evenks.

"Like all native peoples, we are given special opportunities to qualify and advance ourselves in our work," he said. "The opportunities are there, but you have to want to take them."

"Take my own family, for instance. One of my brothers is an engineer with a scientific degree. Another is an animal technician at a cattle-breeding station. I am the mayor of Mirny. Sixty years ago it would have been unthinkable."

Even 30 years ago it would have been considered visionary to suggest that modern towns would be built in an area known to few except occasional hunters and trappers and that it would be possible to travel between them over a good paved road built on permafrost, as we did that afternoon to visit Chernyshevsky, the site of the Vilyui dam 106 kilometres to the northwest.

Once beyond Mirny, the traffic was light, for there is little between it and Chernyshevsky, and most of the way we had the road to ourselves. For long stretches it ran straight across flat country, dipping occasionally and rising to low hills as we approached the Vilyui and Malaya Botuobiya rivers.

"This is where the search for the source of the diamonds was concentrated, along these rivers and out into the taiga following the streams," Alexeyev pointed out. "There was nothing here then except wilderness."

Chernyshevsky, "collecting mushrooms and drying them by a method developed by my experiments and deep cogitation", as he wrote to his wife from Vilyuisk, could not have dreamed of the dam harnessing the river beside which he spent his lonely years of exile.

But as the most consistent of the revolutionary democrats of the eighteen-sixties, men who envisioned the old peasant commune as the approach to socialism and by their thinking and actions influenced the peasant revolts in Poland, Lithuania and Byelorussia, he did dream of ending the national and social oppression of tsarism.

At a "civil execution" staged in 1864, following his arrest two years earlier, he was placed on a public scaffold, a placard pro-

claiming his "crime" hung around his neck, while a sword was broken over his head. Then he was sent to penal servitude, the severest form of exile, at Vilyuisk.

"It's appropriate that we should have named the town after him because he gave light with his ideas and we give light with our dam," observed Valery Kharitonov, the young mayor of Chernyshevsky, in welcoming us at the guest-house where the table was spread with a lunch that would have done credit to the finest of restaurants.

Tall, lean, with an easy informal manner, Kharitonov was a contrast to his friend, Boris Medvedev, director of the Vilyui hydro-electric power plant, whose business suit and white shirt, worn, I suspect, out of courtesy, conveyed an impression of stiffness and formality.

Under my questioning over lunch, it soon became obvious that he was as much at home in the bush as in the office and that the formality was merely a veneer. He was eager to exercise his English.

"When we came here in August, 1958," he recalled, "the helicopter could find no place to land. The pilot flew up and down the river and finally he put us down on a sandspit about 22 kilometres from the site proposed for the dam. There were 18 of us, 17 men and one woman, who was the wife of one of the surveyors.

"We lived there for a month under conditions of primitive communism, catching fish, shooting ducks and gathering mushrooms. We also caught wild turkeys."

"Did you trap them, net them, or what?" I asked.

He chuckled. "It really was quite simple. We opened the flap of the tent, the turkeys were curious, they came in—and we dined well that night.

"That's how we lived, off the land and out of the river. However, we did have flour and Hannah, the surveyor's wife, made very good bread.

"We spent a lot of time examining the proposed dam site and in the end we concluded that it wasn't suitable. So we began working our way upriver until we found this site, which did meet our conditions. So here we were. We were going to construct the first dam ever to be built in permafrost, and I was

chief of construction. I had worked on the Irkutsk dam for eight years, but this was pioneering all the way.

"On this site the Vilyui River cuts through solid dolomite, a volcanic rock, but the surface is fractured. The dam was to be built on bedrock, using a construction technique which had never been tried before, although it had been tested over a four-year period at the Kalinin Polytechnical Institute in Leningrad.

"The design called for the use of rock, clay and sand materials, which had to be available locally, since we would be building a long way from rail and water transportation. The raw materials were all here and we started preparing the site. We got our first electricity from a coal- and diesel-powered unit on the Lena 560 kilometres away. Everything had to be brought in by air at the start, of course, although we did build a snow road to Mirny that first winter. The road you came over wasn't completed until 1966.

"One of our first companions on the site was a bear, a most unusual bear. We had strung a single strand telephone line and it was constantly being broken. We scratched our heads trying to figure out what was causing the breaks. A single break can usually be traced to something like a fallen tree. These breaks were in different places and there seemed to be no logical explanation for them. But there was. One day we came upon a bear and we watched him. He would claw at the wire and stop. Then he would claw again, obviously intrigued by the clanging sound. The culprit was our musical bear."

I asked Kharitonov about the town, of which I had seen just enough to give me the impression of one- and two-storey houses, most with cold frames and small greenhouses in their gardens, ranged in serried ranks on the hilltop above the dam. Here and there a larger building loomed above them, constructed, like the houses, of prefabricated materials assembled on site.

Kharitonov was as enthusiastic about the future of Chernyshevsky as Medvedev.

"Originally this was intended to be a temporary town for construction workers and their families. When the dam was finished, the workers would go to other projects and Chernyshevsky would dwindle to a small settlement for hydro-power workers," he reported.

"The first town went up with this in mind. At the height of construction we had 12,000 people here. But we changed our plans. We decided that Chernyshevsky would be a permanent transportation and maintenance centre for the diamond mines at Aykhal and Udachny farther north and we've been rebuilding the town ever since.

"Some of the workers did go, but a lot of them remained. Now we have about 7,500 people. I am sure that will double in the next few years."

Medvedev broke in to point out that Vilyuigesstroi, the project's official title, is responsible for supplying power to a large area.

"We go 400 kilometres north, 350 kilometres south and 300 kilometres east," he declared. "Everything depends on us. But if anything breaks down when the temperature falls to minus 60 degrees, it's the equipment, not the people."

"What year was it we had the Canadian government delegation here?" Kharitonov asked Medvedev.

"That was in 1971." He turned to me. "We don't see Canadians here very often, but we saw a lot that year. One of your ministers, Jean Chrétien, was here with a group of officials and they were particularly interested in our technology and construction methods. As a matter of fact, Canada is one of the countries which have bought the technology we developed for this dam."

On my return home, I looked up *Siberia 71*, the publication on the delegation's visit to Siberia compiled by Walter Slipchenko, the research officer who accompanied the delegation, and published by Information Canada.

At Chernyshevsky, the questions asked by members of the delegation were much the same as those I asked. One, however, caught my eye. Why had the reservoir for the dam only been cleared for 20 kilometres upstream? The answer given was that it would not have been economic to clear the entire reservoir. And the Canadian observation given in *Siberia 71* was: "The result of flooding timberland upstream and its particular effect on marine life would be useful in appraising future projects of this sort in Canada."

Chrétien's own concluding observation, "Wherever we went

in Siberia we witnessed 20th-century progress", was matched by the importance he placed on Canadian-Soviet exchange agreements and on cooperation between the two countries in Arctic scientific research.

"We had a good exchange of ideas," Medvedev replied when I asked him about the delegation's visit. "In your north and ours we can always learn from each other."

Kharitonov looked at his watch, apologizing for having to leave us and assuring us he would be back later, and we all pushed back our chairs.

"I've told you how we chose the site," said Medvedev. "Now I'll show you the dam and tell you how we built it."

I looked up at the dam in surprise when I got out of the car. After the soaring white edifice at Bratsk, this was a massive grey barrier, its face littered with rubble like any earth dam. In fact, it was a kind of earth dam—a rock and earth dam held together by permafrost. Medvedev was watching me with a slight smile.

"Not quite what you expected, is it?" he asked.

I shook my head and looked around. The gleaming white powerhouse and penstocks above it accentuated the contrast. So did the thin white lines of the roadways crossing the face of the dam.

"That dam is 75 metres in height and we used no cement in the core or the facing," Medvedev explained. "The core had to be laid in winter when the river flow was lowest. It meant that after completion of the construction trench we had to block the river to a height of 40 metres—and seal the first 20 metres of it—in one winter season, working in sub-zero temperatures.

"We built the dam of two filtering layers of crushed rock, the first layer finer than the second. Then we used a mixture of clay, loam and weathered rock to seal it. This caused some problems. We found this facing mixture, which is quite cohesive, on bedrock beneath the top covering of soil and vegetation, but the layers were thin and we needed a great quantity of it. So we had to scour the area as far as five kilometres away to get enough.

"We solved the problem of freezing by using insulated trucks

to carry it and then storing it in large piles heated by electricity. We added calcium chloride to lower the freezing point of the rock core and inserted electric probes in the core to heat it because the facing mixture could not be applied and compacted below minus 40 degrees and at times the temperature went down to as low as minus 60 degrees."

Medvedev had begun his explanation at the foot of the dam, with many digressions while he pointed out the various techniques used. By the time he had finished it we were at the top of the dam looking down the Vilyui. The debris-littered fingers of sandbars poked out from the shore into rippled shallows and the weathered bedrock was bared along the banks.

"That was another of our problems," said Medvedev, indicating the exposed bedrock. "The dam itself is on bedrock, but the wings are on deep permafrost—it goes down about 350 metres. And the bedrock has cracks in it. We anticipated that the heat from the reservoir upstream could melt the ice in the cracks of the bedrock, so we built what we call a grouting gallery—it's a concrete tunnel—from which we can drill holes to relieve water pressure from melting ice and grout the cracks.

"We're monitoring the reservoir closely to see what thawing effect it is having on the permafrost. So far it appears to be very slight and we have been assured that there is no danger.

"Now I want to show you a powerhouse. We have two of them, one here and the other across the river. And the next time you come we'll have a third stage in operation."

Medvedev was anxious that I should understand everything. "What do you smell?" he asked as we walked into the switch room. "That's ozone."

Unfortunately, his English failed him in trying to explain the intricacies of the closed system designed to maintain the temperature and ensure the performance of equipment no matter how far below freezing it was outside. And Lyalya found it difficult to translate technical terms she did not understand.

It was easier when Medvedev suggested that we visit the fish hatchery a short distance below the dam. That was something I understood,

Vladimir Klimov, the director, was a little astonished to meet a Canadian with more than a casual interest in his work.

"After all, if you were visiting our country to see our fishing industry, this isn't where you would come, about 1,200 kilometres inland from our Arctic coast and 1,600 kilometres from the Pacific," he observed. "You would go to our fishing ports on the Baltic or the Far East, or the Caspian and Black seas, and to see hatcheries you would go to the Volga or another of our big rivers."

He was apologetic that he had so little to show me because most of the rearing tanks had been cleaned out. "You've come at a poor time. Right now we're out collecting eggs to begin a new rearing cycle."

With the exception of sturgeon, all the fish reared are Siberian species, one of which, the *tugunak*, is only found in the Vilyui region. Most are members of the sig family, part of the larger salmon family, and the hatchery releases them in large numbers every year—20 million *ryapushka*, the smallest of the sig family, and 50,000 *nelma*, the largest of the sig family.

"We're experimenting in rearing omul and introducing them to local waters," Klimov said. "I imagine you have tasted omul while you have been here. If you haven't, you should. It's a Siberian delicacy."

I assured him that I had and found it delicious.

He nodded agreement. "Then we release 30,000 *chir* every year. It's another of the sig family. And sturgeon, of course. We milk the fish for their eggs and rear 100,000 a year."

I remarked that I had seen no fish ladders at the dam.

"No, you won't find them here. We truck the young fish past the dam to release them in the reservoir. And we conduct our own commercial fishery there. Our annual catch is around 570 tons of fish, mainly pike, *pelyad*, perch and *tugunak*, and we sell it through state stores for local consumption. That way we supply fresh fish to the people in the towns and help to defray the costs of the hatchery."

If flooding of timberland for the Vilyui reservoir had an adverse effect on marine life, it was not apparent in the fish catch.

At that moment Medvedev returned with the car.

We said goodbye to him back at the administration building where our car was waiting to take us back to Mirny. But first he had something in his office he wanted to give me. He returned with a chrome-plated presentation key to the Vilyui dam, 25 centimetres long and weighing half a kilo. It was a unique memento of my visit, but he has no idea of the interest it aroused in security checks of my duffle bag at every airport on my long journey home.

It was close to midnight when we got back to Mirny. Alexeyev had only one request to make. Could I give him a copy of one of my books of poetry for his son who was studying English at secondary school? It was little enough to show my appreciation for a long, crowded and thoroughly enjoyable day.

I looked at my watch. It was one o'clock and we had to be up before dawn again for a flight to Novosibirsk. It seemed I had barely closed my eyes before Alexeyev was banging on the door. He had come to take us to the airport.

Returning to Novosibirsk was like coming back to a familiar place. The waitress at the hotel dining-room welcomed us like old friends and Vasily Lezhnin was smiling happily when he walked in while we were having a belated breakfast. It was a brief reunion. Within a few hours we were saying goodbye to him again at the airport and seating ourselves in the plane for another eight- or nine-hour flight to Ashkhabad, the capital of Turkmenia, close to the Soviet-Iranian border.

I was sitting half asleep and vaguely conscious of what other passengers were doing when the stewardess pulled open the curtains to our rear compartment. Four or five young men in the seats across the aisle were in high spirits and it was obvious that they were amplifying this feeling of good fellowship with spirits of a potable kind. And Aeroflot does not allow either drinking or smoking on its domestic flights.

The stewardess spoke sharply to them, a torrent of Russian that crackled through the compartment. Suddenly the cabin was hushed and every eye was fixed on me. The young men looked

shamefaced. I wondered what I had done to produce this effect.

"What did she say to them?" I asked Lyalya.

She looked amused. "I told her who you were when we came on the plane, but she got it all mixed up. What she said to them was, 'How can you behave so disgracefully in front of a man from the Canadian embassy?'"

I am not sure how the Canadian embassy would have taken that.

CHAPTER XII

Ashkhabad: City of Love

It was 3:30 in the morning when we touched down at Ashkhabad airport after an eight and a half hour flight. Mirny was five time-zones away and, with the stopover at Novosibirsk, we had been on the road for 28 hours.

The contrast could not have been greater. At Mirny, where even the thin bright sunshine of the late northern fall had not dispelled the chill, the men had been wearing parkas and padded jackets, the women woollen coats. At Ashkhabad the men working on the airfield were in their shirts. Roses and callas bloomed in the flower-beds in front of the airport building, the water from an irrigation pipe trickling in brown pools around them, and the air was warm and fragrant.

Despite the early hour, representatives of the Turkmenian State Committee for Publishing were waiting patiently at the airport to greet us, looking as weary as I felt.

"You'll be in good hands," they assured me as they left us at the Hotel Ashkhabad. "Our Writers' Union is having a conference here this week and you will be able to meet some of our writers. One of them, Seyitniyas Atayev, will be accompanying you while you are here."

Seyitniyas Atayev, as I got to know him during the next few days, proved to be a singular man. Big, portly, his hair iron grey, he had a natural dignity at odds with the bright red and yellow shirts he favored and his somewhat rumpled appearance. His energy was boundless and his enthusiasm contagious. And he seemed to know everyone. It was impossible to walk along the street with him without his stopping to introduce me... "He is a well-known writer... She works at one of our institutes... He teaches at our university." At the various institutes we visited invariably the table would be heaped with sweet melons,

water-melons, white, red and purple grapes, and while I was engrossed in discussion he would occupy himself expertly cutting up the melons, offering them around and eating, pausing from time to time to expound a point or amplify a statement —his knowledge of Turkmenian life seemed to be as prodigious as his appetite and he had a journalist's flair, finely honed by experience, for what was important.

While he would readily discuss his work, he rarely said anything about himself or his family beyond the fact that he had served during the Second World War as a major, and what I learned about him was volunteered by others.

"He is our favorite writer," they told me at one farm we visited. "We shall never forget the work he did after the war in finding foster parents for our war orphans."

Others told me of his own tragedy in the great earthquake which devastated Ashkhabad in 1948. As they related it, he was working in his office when the earthquake struck. The office building withstood the shock. His home was among the hundreds destroyed and his wife was among those who died. He spoke about the earthquake, referring to the fact that the city had largely been rebuilt with aid from the other republics, without ever mentioning his own loss.

He disengaged himself from a group of his fellow writers to greet us as soon as he saw us in the lobby. "I know English," he said as he introduced himself. "If you speak slowly, I will understand you. I read English, but I do not speak it often, so you will excuse my errors."

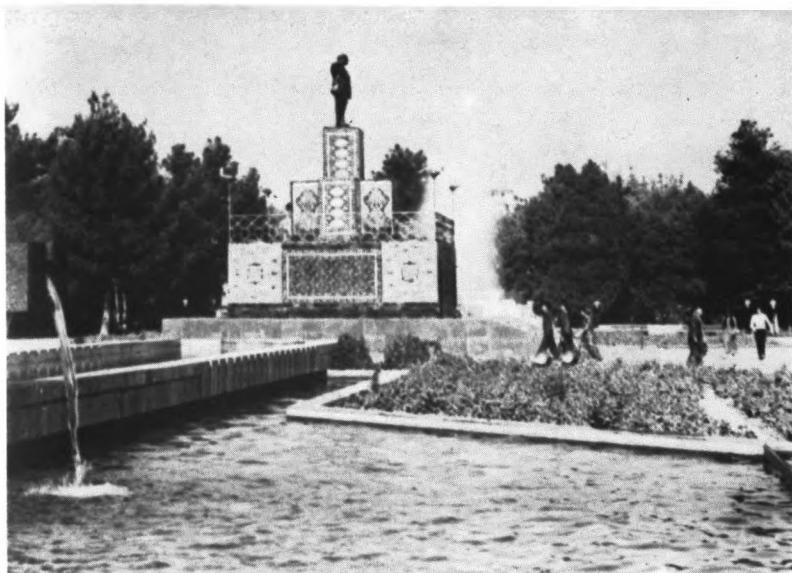
We headed in the direction of the door, but first he had to call us back to the group and introduce us quickly to each one, although I would never remember the names. We started toward the door again and almost got there before he excused himself to talk to a man just coming in. "So many people I know," he said. We waited for him outside.

"See," he exclaimed, stretching his arms to encompass the rose gardens, the wall of fountains and the tree-lined street, "the City of Love."

"Why do you call it that?" I asked.

"That is what Ashkhabad means—*ashyk* means love and *abad* means city. So, the City of Love."

ASHKHBAD



One of the city's gardens



This is what the city looked like after the earthquake of 1948



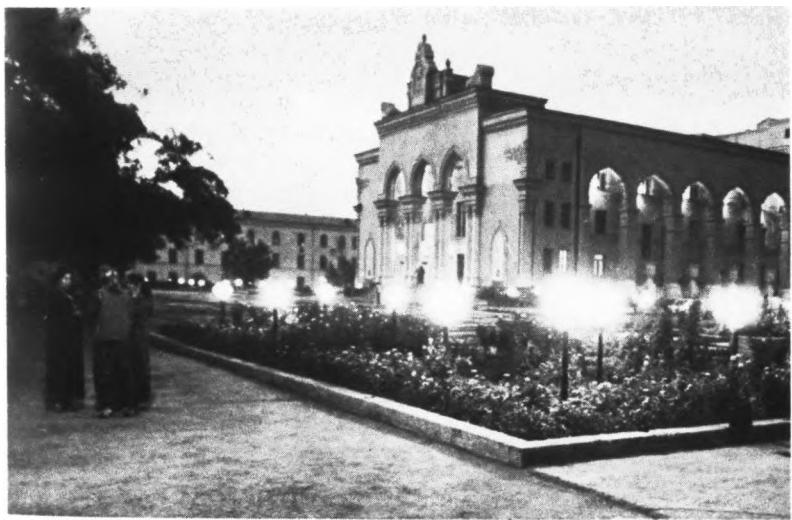
Glavkarakumstoi construction headquarters



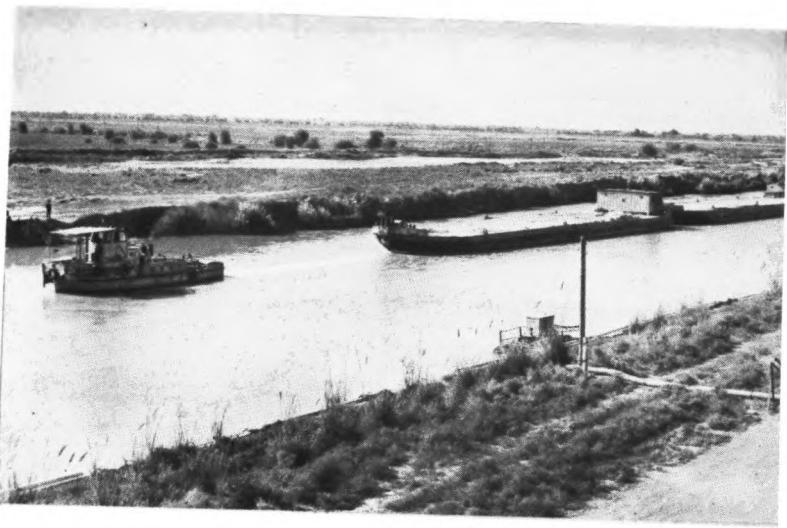
The Karl Marx State Republican Library



A city street



The Mollanepes Drama Theatre

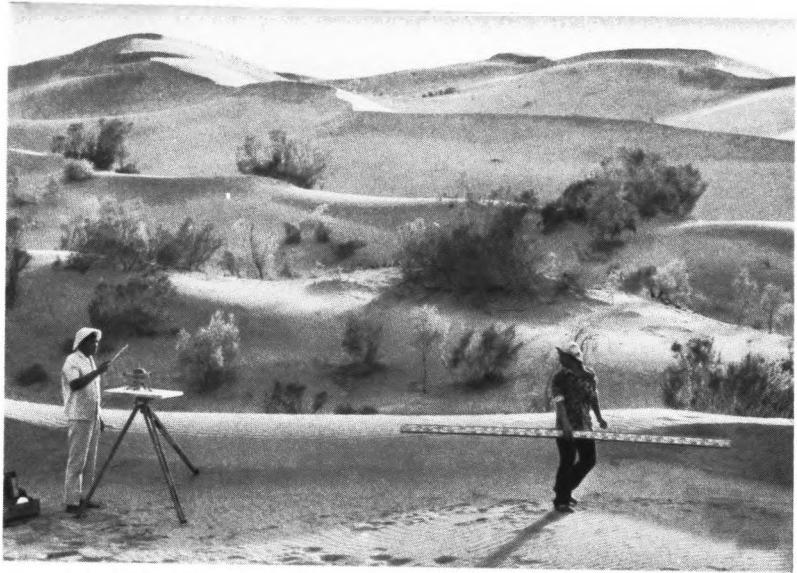


The Kara-Kum Canal





The Kara-Kum Canal has brought this land to life. Collective and state farms have been set up on this arid land

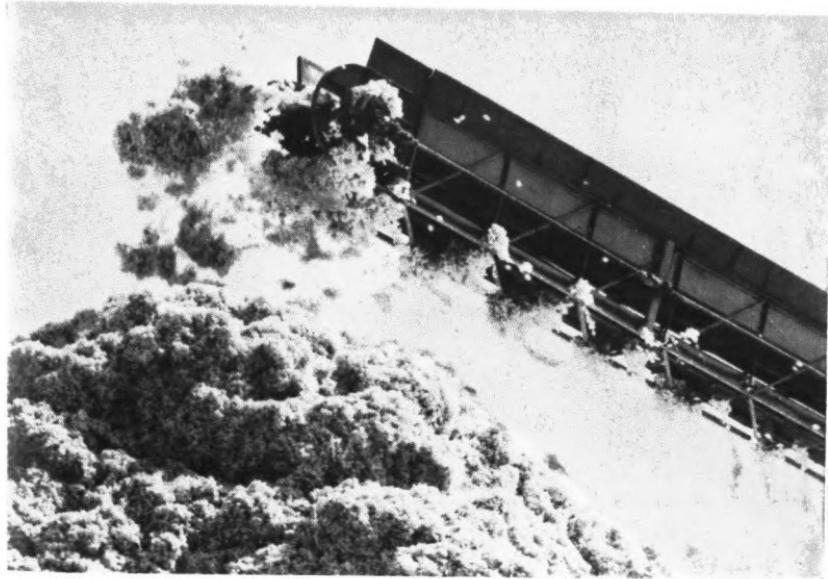


Repetek desert station director Suvkhankuli Veisov (left) studying the Kara-kum's relief

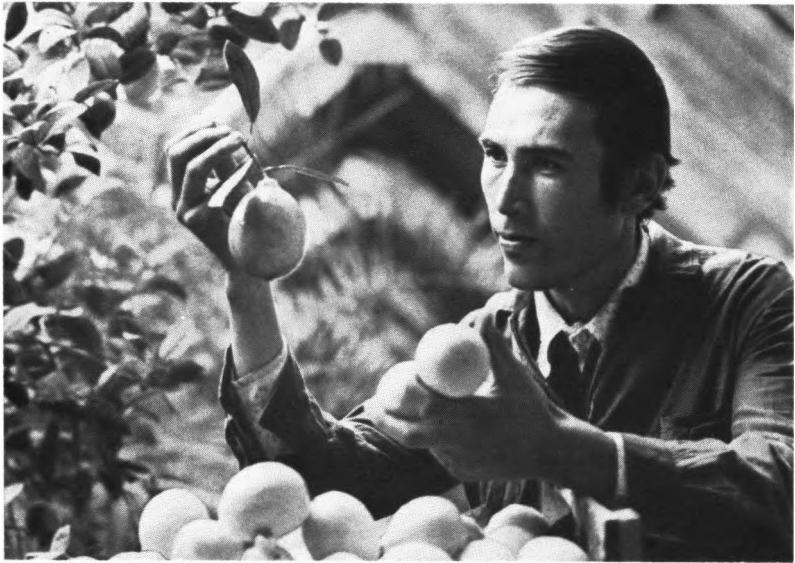


A large flock of Kara-Kum sheep grazing

Cotton-picker Mukhammedova from the Put Lenizma state farm, Deputy of the Supreme Soviet of the Turkmen SSR



A new harvest in the making



The lemon plantation of the Forty Years of the Turkmenian Republic collective farm



The famous Akhal-Teke racers in training

My curiosity was aroused. "There must be a story behind the name," I persisted.

"There is. First, let us get in the car. Good, now I will tell you the story.

"Centuries ago there were two villages close to here, but long before there was ever a city, the villages of Anau and Nissa. The son of the Anau khan and the daughter of the Nissa khan fell in love. Suddenly the order came from God, carried by an angel: love is forbidden.

"Defying the order, the young couple ran off into the desert. Presently they came to a well. But when they tried to drink from it, all the water ran underground because all nature obeyed God. They made their way across the sands to a caravan road to seek water from travellers. Just as they reached the road it rose before their eyes and disappeared. Undaunted, they began to dig a well, but as soon as they reached the wet sand it turned upside down and became dry.

"Then God, seeing how determined they were in their love, sent Azrael, his angel of death, to them. As Azrael approached, the girl climbed out of the well. She was so strikingly beautiful that for the moment Azrael forgot his mission of death. At that very moment the man in the well struck water. Azrael had lost control and now he was too late.

"The water from the well ran into *aryki*—little canals—and thereafter all young men and women who came to drink from the well fell in love. So the settlement around the well grew to become Ashkhabad, the City of Love."

"That's a beautiful legend," I declared.

He looked pleased. "It is a beautiful city," he replied. "Come, we will get out of the car and go on a walking tour so that I can show it to you."

Ashkhabad is a beautiful city. We walked along green, heavily shaded streets on which trees growing on both sides of the sidewalk formed a canopy overhead against the hot sun and through squares and parks where fountains splashed amid carefully tended beds of roses, callas, marigolds and portulaca. The mauve bloom of the ailanthus trees stood out against the shadowed foliage and littered on the ground were bright lime-green fruits about the size of a small grapefruit. Cutting one

open with my pocket knife and examining the pale green pulp, I asked Seyitniyas what it was.

"We call them *maklyura*," he said. "The English word I do not know."

I turned expectantly to Lyalya. Ever since we had been in Akademgorodok, she had carried her dictionary with her, thumbing through it constantly to find the English words to answer my questions, many of which, as she reminded me, required expert knowledge in fields as diverse as archeology and chemistry.

She consulted her dictionary and looked baffled. "I don't know," she said finally. "I think it must be breadfruit."

Turkmenian architects have placed their distinctive stamp on the city's glass and concrete buildings in the style of the Hotel Ashkhabad and the Karakumstroi building, with their bold sculpture in national motifs, and others in the style of the Mollanepes Drama Theatre and Turkmenian Academy of Sciences in which the high soaring arches and inlaid ceramics reflect the Iranian and Arab influences that are part of Turkmenia's ancient heritage.

In the same imaginative style, Turkmenian sculptors have created a unique monument to Lenin in ceramic tile incorporating the traditional patterns preserved in Turkmenian carpets.

"We have come a long way since the revolution," Seyitniyas said as we seated ourselves on a bench in one of the parks. The young woman at the other end of the bench looked up, glanced curiously at us and resumed her reading.

"This young woman beside us. She appears to be a student. Before the revolution she could not have gone to school. The very few schools we had were for the sons of the wealthy. Women were not educated at all. They were illiterate. So were most of the men. Only seven out of every thousand could read and write. But women had no rights. Their only value was the *kalym*, the bride money the man paid to the woman's family, after which she became his property. On the street she wore a *paranjah* to conceal her face and figure. Now look at the change."

He waved his arm to indicate the women walking through the park and seated on benches around us. Some, like the young

woman beside us, wore light summer dresses. Others, and particularly the younger women, wore the colorful ankle-length national gowns embroidered in contrasting colors down the front. All had kerchiefs tied around the back of the head, but hair styles varied, short, long and most favored of all, two long plaits often falling well below the waist.

Seyitniyas shook his head. "It took years to come this far. The old ways die hard. At first a lot of people resisted the changes, even the women, because the outside world had been for men and it was new and strange to them. Not any more. Now every position is open to women."

A man walked past, hesitating when he saw us. Seyitniyas excused himself and hurried after him.

"He is one of our literary critics, a very good critic," he explained when he returned to the bench. "He is going to review my new novel, which has just been published. He was kind enough to say that he thinks highly of it. But I have to see my publisher. My contract says 50,000 copies and I am told only 10,000 copies have been printed."

"Most Canadian novelists would be happy to have a first printing of 10,000 copies," I told him.

"Yes." It was a question as much as an exclamation. "But it is time we went to our Writers' Union. I want you to meet Khydyr Deryayev, our deputy chairman. He is a novelist and a poet. He is also a deputy to our Supreme Soviet."

"Has his work been translated into English?" I asked as we walked back through the park.

"I think parts of his novel *Fate* were published in the English edition of *Soviet Literature*. It was a very long novel, four books, I believe, and it would have been a big job to translate it all."

The high-ceilinged room into which we were ushered, cool after the heat of the street, was hung with the carpets for which Turkmenia is renowned, woven with portraits of Lenin, Pushkin, Gorky, Tolstoy and the eighteenth-century Turkmenian poet, Khojan Niyaz.

It was still another instance of how Turkmenians have blended tradition, as in their sculpture and architecture, with an art so ancient that no one knows when it began. I already had

visited a carpet plant in the city, one of twelve in the country, watched the women working with deft fingers at their big looms and admired the soft, deep red handwoven carpets shown to me by Aziz Bagirov, chief of the arts experimental section, a man to whom carpets like those hung in the Writers' Union are rare treasures, the old masters of the carpet art.

Khydyr Deryayev, a short, grey-haired, kindly man, rose to greet us as we entered and waved us to seats at a table heaped with fruits, cookies and candies. Seyitniyas immediately busied himself pouring cups of tea and slicing up the melons.

"I was telling our guest how far we have come since the revolution," he said, "and about our novelists, poets, dramatists and critics."

"But first, poets," Deryayev pointed out. "Poetry was our main medium, handed down from generation to generation. Traditionally we had very little prose writing. All our ancestral memories as a people were preserved in our poetry. Turkmen was a spoken language—it's part of the Turkic-Urdu group of languages. What writing we did was in Arabic. After the revolution (in 1928) we abandoned Arabic for a Latin alphabet, which we used until the eve of the war. Then we discarded it for our present alphabet, which is adapted from the Cyrillic alphabet for the spoken Turkmenian language.

"Today we have 140 members of our Writers' Union writing in Turkmenian. Only ten of our members write solely in Russian, although some of our members write in both languages. We have two literary journals, one published monthly in Turkmenian and the other published bi-monthly in Russian. And we also publish a daily newspaper, *Literature and Art*, in Turkmenian. It is very popular. The population of Turkmenia is three million and Ashkhabad has around 300,000 people. Our newspaper has a circulation of 100,000. We have indeed come a long way."

The beginnings of the territory which has evolved in Soviet times into the four Union republics of Turkmenia, Uzbekistan, Tajikistan and Kirghizia, go back to the emergence of civilization in Central Asia.

Central Asia lay at the centre of the overland trade routes

between west and east and in the path of every invader, whether from south, west or east.

Fascinating as it is, so long a history has its deepest meaning for those whose history it is. I asked Deryayev about the origins of his people and I knew from his face that I had touched a subject close to his heart.

"Turkman means 'I am a Turk,'" he began. "The ancient Oghuz tribes, part of the Turkic peoples, originally lived in the Altai region. Ours is a very long story, intertwined with that of other Turkic peoples, of warfare against the Chinese on the borders of Mongolia which forced the Turkic peoples northward and westward.

"The Turkmen began their migration westward across what now is Kazakhstan in the sixth century and their migration to the present territory of Turkmenia took place over so long a period that by the time the last wave of migrants reached these parts, the first wave had already intermixed with the original Iranian population.

"In the Turkmenian territory the Iranian population was assimilated, leaving a physical imprint which is present to this day. There are large Turkmenian minorities in other countries such as Iran, Iraq and Turkey, but they have largely been assimilated. In the Soviet Union, however, nearly all the Turkmenian people live within the borders of Turkmenia."

Between 1864 and 1885 tsarist Russia annexed the Central Asia territories eventually consolidated into Turkestan. Turkestan remained predominantly feudal until the revolution, but increasingly its people were drawn into the gathering revolutionary storm against tsarism. And during the Civil War, when Turkestan was cut off from central Russia by the whiteguard armies, its peoples came into their own, foiling British intervention and counter-revolutionary coups and opening the way to their national fulfilment as Soviet socialist republics, beginning with the creation of Turkmenia and Uzbekistan in 1924.

"The people grew, but the water supplies did not," Deryayev said, speaking of the years before the revolution. "The wealthier landowners held control of the water supplies, forcing the landless peasants into a nomadic existence."

For the Turkmenians, water is the most precious of all re-

sources. It seeps through their legends, shapes their development and influences their lives. And they have so little of it. When God was handing out the water, they say, the Turkmenians were asleep and all they got was a trickle.

Throughout the centuries they have made the most of that trickle, at the oases where water comes naturally to the surface, by digging wells and using primitive water-lifting devices to divert water into irrigation systems. In all that time, the pattern changed little.

"Our poet Khojan Niyaz urged Peter the Great to build a canal. He saw it as a means of unifying the Turkmenian people on the shores of the Caspian Sea," Deryayev pointed out. "Khojan Niyaz urged Peter, 'If you build a canal, you can navigate the territory and establish trade with the Mongols.' But nothing was done and his dream died in the sand."

After the Russians began their advance into Central Asia other ideas were advanced and they too died in the sand. Not until the Kara-Kum Canal was started in 1954 were the Turkmenians able to begin the work of transforming their country, no longer a struggle to eke out a bare existence on arid land, but a task that rewarded them with bountiful harvests. Nor were they only reclaiming all that lack of water had denied them. The Kara-Kum itself yielded large deposits of oil and gas hidden beneath its sands.

Beyond the Amu-Darya River, which flows northward along Turkmenia's eastern border, and the Kara-Kum Canal, which diverts some of its water westward, the Kara-Kum Desert is a huge area spread irregularly over 80 percent of the republic's territory. Yet, although it confines agriculture to naturally watered and irrigated lands, it is neither completely lifeless nor unproductive.

At the Ashkhabad Institute of the Desert scientists are dedicating their lives to studying it and the research work they are doing and what they have learned from it has earned them international recognition.

The remote fastnesses of the Kara-Kum are still the haunt of the *jairan*, the Central Asian antelope, and the *kulan*, the wild ass. Karakul sheep and camels graze on the sparse dry grass and desert plants whose roots go deep to water below

the sand, but no longer as they did when their herders were nomads wandering in search of water. Now the desert and its borderlands are managed scientifically.

"What we have learned is that the desert is the most unstable eco-system, although that may sound strange because the Kara-Kum has existed with little change for thousands of years," said Abdurakhman Ovezliyev, the institute's affable director, when I met with him and a group of his colleagues. "The fact remains that it is unstable and any reckless development could have serious consequences to climate."

"The rainfall in the desert is between 100 and 150 millimetres annually, mainly in the fall and winter. The summer temperature rises to 50 degrees, but in winter it falls to minus 30 degrees. There is water deep underground, but it is saline.

"What we have done is to develop a method of collecting rainfall in underground reservoirs which we call *takyr*. These reservoirs have porous bottoms through which the water seeps to the naturally saline groundwater. Because the groundwater is heavier it remains below the seeped groundwater so that the *takyr* can be used for watering sheep and other stock. We use these *takyr* in those areas of the desert—altogether they amount to two million hectares—that have a clay and soil surface. When you consider that under natural conditions the water evaporation capacity of the Kara-Kum exceeds its rainfall in the order of 15 or 20 times, you can appreciate what this means to us in rearing livestock."

In its research and experimental work to make use of the desert's own plant resources in reclaiming semi-desert areas from the sands, the institute operates two laboratories, one at Ashkhabad and the other out in the desert at Repetek.

"We can't take too much from the desert lands," said Suvkhankuli Veisov, director of the biosphere and desert laboratory at Repetek, taking up Ovezliyev's account of the institute's work. "We know that we must not try to reclaim all the sands because they act as a sieve through which the rains seep to the underground lakes. If we attempt to cover them with grass, this would hold the moisture and stifle the natural process. Then we would lose the underground sources."

"We also know that the natural productivity of the desert

lands is low and we believe we can double it," Ovezliyev added. "When the rains fall the soil retains the moisture for a short time. So, to hold the moisture, we plow the land in narrow strips and plant it to grass. The narrow strips concentrate the rainwater and the grass roots spread in the area.

"We use the same strip method in planting trees to serve as a barrier against the sands in reclaiming land, varieties like willow, acacia, elm, ash, elder and a desert tree we call *saxaul*."

I had seen *saxaul*. From the road it bore some resemblance to a young cedar. But the fronds were thin and feathery and no cedar could have grown in that sand.

Since the institute was founded in 1962 the tree belts planted to hold back the sands have been extended over a huge area and 400,000 hectares of land at the desert's edge in what have been defined as borderlands have been improved for agricultural purposes.

"In fact," Ovezliyev reported, "we are improving them now at the rate of 30,000 hectares a year."

Now the institute's scientists are turning their attention to those Kara-Kum lands being used only for grazing. They are convinced that they can be used for other agricultural purposes, such as growing maize, sorghum and alfalfa.

The reclamation of borderlands by grassing has made it possible to run karakul sheep the year round.

The production of karakul sheep is important to Turkmenia's economy. The republic has five million of them, and more when the right of every kolkhoz family to have up to 50 sheep is taken into account, and it produces one million every year.

To obtain the fleece from the unborn lamb, the mother must be killed, but in Turkmenia only old ewes nearing the end of the reproductive cycle are killed. The normal gestation period is 150 days and the ewe is killed at 135 days, providing both fleece and meat.

"These sheep have almost a symbiotic relationship with the desert," Veisov observed. "When they are reared in the desert they produce karakul fleece. But only as long as they are in the desert. If they are removed from the desert, they don't produce the fleece."

I knew when I broached the question of diverting water

from Siberia to assure Turkmenia of future water supplies that it would enliven the discussion. And it did.

Already I had been given an inkling of what I might expect from Tanarutberdy Niyazov, director of the Turkmenian Exhibition, who was inclined to dismiss Siberian fears as groundless provided the particular diversion projects were fully considered.

"As I recall," he said, "there was no end to the sceptics who didn't want the Kara-Kum Canal built because they were afraid it would have adverse effects."

Deryayev's opinion had reflected the same concern I had heard in Siberia. "Whatever is done," he told me, "nature must be respected, for the price of disrespect can be high."

The response I got at the institute was measured.

"We have studied the effect of the Kara-Kum Canal on climate and we have found none on a global scale," Ovezliyev said. "The local effect is both good and bad—good in that there are more trees, more sheep, more cotton, but bad in that there is an accumulation of drainage waters. Now we are re-examining the system of open canals and studying the possibility of installing closed systems where it is economically feasible."

"Don't forget all the people in Ashkhabad who blame every variation in the weather on the Kara-Kum Canal," Seyitniyas interjected.

"I wonder what they blamed for the weather before the canal was built," some one grumbled.

"In any case, all our available water resources will be fully utilized by the year 2000," Ovezliyev declared. "We are seeking every possible way of using rainfall and every source of water. Even so, we see no alternative to bringing water from elsewhere and the logical source is Siberia which has no lack of water."

"We all understand that Siberia will be adversely affected if too much water is taken. Guri Marchuk, the former vice-president of the Siberian Academy of Sciences, made that quite clear when he spoke to us in Ashkhabad. And we all agree that thorough studies must be done before any decisions are made. But only part of the river waters will be taken for the needs of Central Asia and we don't think that this will harm Siberia."

I got much the same response from Nurmuhammed Khanayev,

the young, earnest deputy chairman of Karakumstroi, the Kara-Kum construction organization which is responsible both for building the canal and the cattle-breeding stations and fish hatcheries along its length.

"Future water will have to come either from reservoirs or from Siberia," he said in answer to my question. "The Amu-Darya River, which is also tapped by Uzbekistan, has 95 percent of all our water and there is a limit to how much we can take from it. We have a loss from evaporation, but the cost of lining the canal would be prohibitive."

Year by year since work began on it in 1954, the Kara-Kum Canal has been extended farther along the Kopet-Dag foothills on the Turkmenian border, starting at the old Bosaga-Kerki Canal and now stretching 1,050 kilometres to Janakhir, where the fourth stage is being completed. As the canal has been lengthened—to Murgab in 1959 after the Murgab River could no longer provide enough water for the area's needs, to Tedjen, site of the Khauskhan Reservoir, and in 1962 to Ashkhabad, dependent on underground streams and perennially short of water—reeds have grown along the waterway and dry borderlands have been transformed into fertile farmlands.

Ultimately, when it reaches Kyzyl-Atrek, near the Iranian border inland from the Caspian Sea, the canal will extend for 1,400 kilometres, with one branch carrying water to the Nebit-Dag, centre of one of Turkmenia's oil and gas areas, and the Krasnovodsk industrial area, where there are oil refineries, gas and superphosphate plants.

"After the water gets to Kyzyl-Atrek, we can grow citrus fruits such as oranges, tangerines and lemons on a large scale," Khanayev declared confidently. "That's our sub-tropical area where we grow olives, figs, almonds and pistachio nuts."

At the same time as it lengthens the canal, Karakumstroi is widening it. The first 450 kilometres already are navigable and eventually boats will be able to ply the canal halfway across Turkmenia to Ashkhabad.

"That will be a big day for Ashkhabad," said Seyitniyas. "It is hard to believe that boats will sail through the desert lands all the way to Ashkhabad."

Khojan Niyaz's dream of a canal to unify the Turkmenian

people on the shores of the Caspian Sea is becoming a reality, and on a scale that he could not have visualized.

"When we finished excavating on the fourth stage of the canal to Janakhir, one of our team leaders asserted that we would have to change the name of the place," said Khanayev. "I asked him why. He pointed out that Janakhir means 'the end of life'. When the water comes here, he said, the name should be changed to Teze Durmush, which means 'new life'."

To the Turkmenians, water always has meant life. And as the canal carries the water across the country the new life they are creating for themselves follows behind it.

Walking back to the hotel through shaded streets and flowered squares, Seyitniyas indicated the fountains sparkling beneath the soaring obelisk to the war dead.

"None of this was possible until we got the canal water," he said. "Ashkhabad was always short of water in the summer. Without it we could not grow. Since the Kara-Kum brought the water to us, we have used it to make our city green. You have seen the water running down the lined channels of our streets. It gives life to our trees. But we do not waste it, for water will always be precious to us."

Later that day he took me out to the Gurtli Reservoir outside Ashkhabad, one of the smaller ones, as he explained. "The largest is the Khauskhan Reservoir and the new Zeis Reservoir being built now will be even larger."

When we reached the reservoir over a road winding through sandhills, a huge saucer surrounded by a broad rim of beach on which the sun beat down mercilessly, Seyitniyas insisted on climbing a sandy slope where he poked away for a few minutes with a stick. He beckoned to me and I climbed the slope after him.

"See," he said, "this is how the desert plants survive." He had exposed some of the long roots of a bush running for several metres down the slope. "In the desert the vegetation and the people are..." He groped for a word.

"Tenacious," I suggested

"Yes, that is it, tenacious."

Where Water Is Life

Before I went into the countryside around Ashkhabad to see the farmlands brought into being by the waters of the Kara-Kum Canal, I decided I should talk first with Annamukhammed Charyev, pro-rector of the Kalinin Institute of Agriculture. The older style building that serves as its headquarters is in the heart of the city. Its various departments are spaced around the country from the semi-tropical region bordering the Caspian Sea to the desert borderlands. And the experimental work in which its staff of around 1,000 people are engaged is concerned, not as in Siberia with permafrost and the development of new cold-resistant strains, but with better utilization of the borderlands, irrigation and conservation of water, as well as improvement of the cotton, vegetable and fruit varieties already grown on a large scale.

"What has the Kara-Kum Canal done for us?" asked Charyev, repeating my question after tea had been served and I had explained my purpose. "It has enabled us to double the lands we have under irrigation and made it possible for us to use machinery economically.

"With irrigation we have increased the area under vegetables in the Kopet-Dag around Ashkhabad from 5,000 to 100,000 hectares. Now there are 24 state and collective farms in the vicinity of the city. Think of what that means to us in food production."

Seyitniyas nodded thoughtfully. "The land was fertile. We brought water down from the hills. We drilled wells. We tapped underground streams. There was never enough."

"Then we have the borderlands," Charyev continued. "They posed another problem for us after the canal was cut. How were they to be cultivated? We solved that by planting them with

grapes and melons, which can be shipped to areas of central Russia and Siberia where they cannot be grown. Now we are investigating what other uses they can be put to—what other crops can be grown.

"Cotton is a different problem. Not everyone realizes how much water it takes to grow cotton—10,000 cubic metres for every hectare under cotton. We start watering at the end of May and continue every ten or twelve days through mid-September. Cotton has always been an important crop for us and we have been growing it for a long time. Always we were limited by the amount of water we could put on the land. With the Kara-Kum Canal we have increased the area of land we have under cotton one and a half times.

"I hope you will see one of our cotton farms, one growing the new thin strand variety we have named Ash-25, developed by our Maria Babayeva. It's our 'silk cotton' and we believe it's equal to the best grown anywhere."

In the foyer on my way out I stopped to look at the oil paintings hung there, paintings of a period now past but not so distant that it has been sponged from memory, when boys who would never have the opportunity to go to school led the camel pulling the wooden plow through the dry soil, and water was wealth, but not for the peasants.

My short visit to the Soviet Turkmenia kolkhoz on the outskirts of Ashkhabad was more of an introduction to the Forty Years of the Turkmenian Republic kolkhoz, 60 kilometres from the city, where I spent a day. But the scale and scope of both were enough in themselves to dispel the myth so assiduously cultivated in the West about the inefficiency of Soviet agriculture.

This was what in Canada and the U.S. has come to be called agri-business, but not enterprises devoted solely to the raising and processing of chickens or certain specialized crops. This was combination farming on the same large scale, using every drop of water pumped from the Kara-Kum Canal to the fullest and every type of machinery to lighten the work of cultivating and harvesting, but with none of the alienation and exploitation of private enterprise.

Every kolkhoz member I spoke to—and I spoke to many—

had a personal interest in the success of the kolkhoz transcending quotas and bonuses. Most recalled the time before the Kara-Kum Canal reached Ashkhabad when the land they were harvesting lay beyond their reach for lack of water, fit only for grazing animals.

At the Soviet Turkmenia kolkhoz I went out into the fields, a word that loses its meaning when applied to tracts stretching to the far distance, and watched the water trickling through the lines of irrigation channels where winter wheat thrust its bright green spikes out of the damp soil. Outside the field, beyond the reach of the water, I picked up a handful of soil and let it sift through my fingers. It was like powdered silt.

Where the water ran in a ditch along the edge of the field, however, the grass was lush and green and tethered in it were two camels, lifting their heads occasionally to peer at us in the haughty way that camels have.

"Do you have many camels?" I asked.

"We have 500 dairy cattle, 1,500 beef cattle, 4,600 sheep, 4,200 pigs, 160,000 chickens, and yes, we have 260 camels. We keep them for milk, meat and camel hair. Perhaps you would like to taste camel's milk?"

This was more than I had been able to do during the month I spent in Iraq a few years ago. There, surprisingly, I saw only three camels—two of them dead in the ditch along the straight flat highway from Mosul to Samarra where the roadside is littered with tires that have burst under the heat.

I needed no further invitation. And that is how I came to visit a kolkhoz home, a roomy cottage heavy with grape vines set in a garden where the roses were the Peace and other varieties grown in Canada.

At the back of the cottage a thatched canopy shading a raised platform covered with Turkmenian carpets and cushions offered relief from the blazing sun. Beyond it, beneath a thatched shelter, two camels were tethered beside a white ass, a mother and her yearling calf. The mother had just been milked and the milk tested.

After everyone had been seated on the platform around a low table heaped with fruit, I was handed a glass.

"Drink it," Seyitniyas directed me. "It is good for your stomach."

I had some doubt about that, but dutifully I drank it, draining the glass. It had a slightly acid taste, but I found it quite palatable.

Lyalya, who had refused a glass, looked at me in amazement. "I never thought you would drink it," she declared.

"It's good for your stomach," I told her. "You should try some." She shook her head.

"It is what we call *chal*, camel's milk with water, and it is considered to be the best drink to take in hot weather like this," Seyitniyas explained. "There is a recommendation now for it to be produced commercially."

He was busy cutting up water-melons and passing around the flat round Turkmenian bread as he talked. "We have several drinks good for the hot weather, like camel bush boiled in water, but here we will drink tea. It is also good for your stomach."

It was hot, even under the shelter, and the flies buzzed around in swarms as we ate, not in the least deterred by the swatting from all sides. I was grateful they were not horse-flies.

Like Verkh-Irmens, the village for members of the Bolshevik kolkhoz south of Novosibirsk, the villages for members of the Soviet Turkmenia and Forty Years of the Turkmenian Republic kolkhozes are small towns in their own right, with their own cultural and recreational facilities, despite their closeness to the city.

I had a better opportunity to see these when I went to the Forty Years of the Turkmenian Republic kolkhoz and talked to its chairman, Kerim Akhmedyarov, a most interesting and knowledgeable man.

"He was trained as an agronomist at our Institute of Agriculture and as the former chairman of the Soviet Turkmenia kolkhoz he is credited with having transformed it into the prosperous farm you have seen for yourself," Seyitniyas told me as we drove out to the kolkhoz. "He was also the Minister of Agriculture in our government here for seven years, but his real love is the land and he asked to be relieved of his post so that he could return to farming."

Seated across the desk from me in his office, Kerim Akhmedyarov regarded me contemplatively and his weatherbeaten face betrayed no animation. But as he sensed my interest, he was no longer giving me statistics, but talking about strains of cattle, types of soil, uses of the borderlands, all the things that made his farm a thriving entity. Here was a man, obviously a capable administrator, who really loved growing things.

"Let's go see for ourselves," he said presently getting up from his chair and reaching for his hat.

"There are 10,000 people here—1,400 families and 1,600 workers," he told me as we drove through the village. "Here is one of our schools—we have three schools and 3,000 schoolchildren. And we have nursery schools, of course, because we have another 3,500 pre-schoolchildren."

He stopped to speak in Turkmenian to a man walking along the side of the road. Seyitniyas was the only one of us who knew all three languages, Russian, Turkmenian and English, and Lyalya was as lost as I was.

The cottages on the side-streets were much like the one I had visited earlier, shrouded in greenery and all, it seemed, with well-tended gardens.

Then we were out in the open farmland, passing fields of cabbages, small herds of camels, larger herds of dairy cattle in various blends of grey and brown. I asked Akhmedyarov what breed they were.

"They are derived from a cross of native Turkmenian and Swiss breeds," he said. "The milk yield is anywhere from ten to twenty litres a day. The daily average is ten to twelve litres and the yearly average is 2,500 litres. We ship the milk to Ashkhabad now, but we intend to build our own plant here to process the milk and manufacture cheese."

Turkmenians are known throughout the Soviet Union for their horsemanship and their Akhal-Teke horses are their pride. The kolkhoz has a herd of 82, big handsome animals with a stamina and spirit to match that of any rider. They are the product of 3,000 years of breeding, sought after as cavalry steeds for centuries and the ancestral stock from which the Arab and other breeds have been derived.

Then we were at the Kara-Kum Canal, the fields with the

endless rows of cabbages far behind. First, Akhmedyarov wanted to show me his pumping station and then we were going out into the borderlands to see the melons.

Around Ashkhabad the Kara-Kum Canal is more impressive in its achievement, evident in the irrigated lands along its length, than in itself. Farther east, on the widened navigable section, it takes on the dimensions of a broad river. Closer to Ashkhabad it is like a huge ditch through the desert and its borderlands, flowing where once there were caravan trails and cutting through sandhills on which the sparse grey-green vegetation clings in startling contrast to the rich green of the reeds and grasses along its edge.

We crossed the canal on a bridge, passed a speedboat on the bank covered with a tarpaulin against the sun, and drove along a sand track to where a dredge stood among the reeds. The young operator was making tea in his shack and with the unfailing courtesy of the Turkmenian people, he wanted us to stay and have some with him. Seyitniyas explained to him gently that we had no time and he looked disconsolate.

While Akhmedyarov busied himself at the pumping station, Seyitniyas translated for me as I talked with some of the workers there. I could appreciate the depth of their feeling, almost a reverence, for the water, but what surprised me was their poetic phrasing of that feeling, the living expression of their poetic heritage.

"Without water we have no life," declared Anha Nazar Ko'Shek, a young technician. "This station pumps water like my heart pumps blood."

And Murat Yazlanov, the team leader, told me with a smile, "Every time I look around me and see what we have grown, I feel glad that I have helped to make the desert blossom where before there was only sand. My heart goes to the city with the sweet melons we send there."

Back of the Kara-Kum Canal stretch the borderlands, flat and undulating areas now being used extensively for growing melons and grapes. And beyond the borderlands lies the Kara-Kum Desert, its shimmering dunes carved by winds into waves and hollows.

The closest comparable area in Canada to the Kara-Kum

borderlands is the arid belt in the British Columbia interior between the Coast range and the Rocky Mountains stretching irregularly from Osoyoos north past Lytton, where the temperature in summer can rise to 34 degrees. There too on the sage-brush flats and dry benches high above the Fraser and Thompson rivers the land needs only water pumped from the rivers to produce melons and cantaloupes.

The Kara-Kum borderlands have the water and their production is astonishing. The tract Akhmedyarov showed me was dotted with melons—the bright yellow of sweet melons and the striped green of water-melons—as far as I could see. Among them ran shallow irrigation channels but, like the soil, they were dry.

"The melons are ripening fast now. They do not need water," said Akhmedyarov, divining my question. "We have already taken a lot of them." I was not surprised when he added that the kolkhoz ships 5,000 tons of melons a year.

My visit ended, as it had at Verkh-Irmens, with a superb meal, but this time of Turkmenian soup and meat dishes, Turkmenian bread, replete with grapes and melons of every variety. In vain I protested that I could eat no more, telling them that I had grown up in the depression days of the Hungry Thirties and that my capacity for food had been permanently constricted.

Seyitniyas took me seriously. "We remember what it is like to go hungry," he declared. "May those days never return. Now we eat." That remark inspired another toast.

Afterward I plied Akhmedyarov with questions about the membership of his kolkhoz, eliciting the fact that the annual production from the 5,000 hectares under cultivation is worth 16 million roubles. This, he added, included income from the farm's own fruit and vegetable cannery, which produces five million cans a year, and its winery, which processes part of the annual yield of 4,500 tons of grapes.

"The average amount we pay out to our members is 230 roubles a month," he reported. "Bulldozer operators receive around 400 roubles and workers in animal husbandry 367 roubles. At the end of the year members also get approximately 80 kopeks for each rouble earned."

I asked him if his kolkhoz had any difficulty in keeping its young people, particularly because it was so close to the city.

"Of course some young people leave," he replied. "Not all of them want to work on the land. But Turkmenian family ties are very strong. In any event, we have no problem here because the city is so accessible."

"These days the work is much lighter than it used to be. Everything is mechanized, even the tomato picking, although we still have to pick the vegetables by hand—our clay-type soil makes it difficult to do it efficiently by machine. But 20 years ago we would have required six times as many people to work the same land."

"One way to measure our progress is to look at what our families have. In the thirties it would still have been hard to find a bicycle around here. Today there are around 1,000 cars among our families."

My last visit was to the Put Leninizma state farm about 60 kilometres from Ashkhabad. In Uzbekistan some years ago I had found it tantalizing to be driven past fields of cotton, the wheels of the car stirring up the fallen cotton bolls lying like snow by the roadside, without having the opportunity to stop.

"Here you will have that opportunity," Seyitniyas promised me when I explained my earlier disappointment

The tsarist government promoted the expansion of cotton growing in Turkestan after the conquest of Central Asia, encouraging its cultivation at the expense of wheat and other grains. High tariffs on imported cotton maintained a higher price in the home market and equal taxes levied against land under cotton and grain made it more profitable for landowners to plant cotton. At the same time, manufactured textiles imported from European Russia displaced locally woven cloth and imported Russian goods disrupted the self-sufficient village economy, forcing the peasants to grow more cotton to obtain the cash needed to buy the imported goods.

At the mercy of Russian buyers and the feudal *beks* and *beyis* who acted as their middlemen, compelled to borrow money at usurious interest rates—four percent a month was common—many of the peasants were forced to sell their land. They swelled the number of sharecroppers for whom the growth of cotton

production meant only a continuation of their struggle for a bare existence. Yet, because they still worked within the confines of the feudal system, the changes which made that system hollow appeared to be sanctioned by tradition.

Despite the increased production from Turkestan, tsarist Russia was still importing cotton before the revolution. Today the Soviet Union grows more cotton than any other country, producing one fifth of the world's annual output. At the Put Leninizma state farm I saw how it is being done.

The Put Leninizma is primarily a cotton farm, although it also runs 1,200 cattle and 6,000 sheep. And just as Akhmedyarov had done two days earlier, its director, Kurban Orazov, who holds a Candidate's degree in agricultural science, responded to my questions by saying, "Let's go out to the fields. I can explain things to you better there."

The cotton fields when we reached them were a sea of dusty green speckled with the foam of cotton. Here and there a primrose yellow cotton flower, butterfly petals around a saffron centre, was still in bloom, but the crop was being harvested and once the machines lined up by the roadside had finished their work, the plants would be plowed up and the entire field sown to lucerne grass in a crop rotation pattern.

"Here," said Orazov, plucking a cotton boll, "feel this." The cotton was smooth and silky to the touch. "That's our silk cotton —Ash-25. Here we grow both thin and thick strand cotton and we think our varieties are better than the Egyptian. But without the canal water we could not grow anything. Before we got the water all this was just desert."

He called to one of the waiting operators to bring his machine over to the edge of the field where we were standing.

"This machine is entirely Soviet-designed and manufactured —each one costs us 7,400 roubles," he said proudly. "See, the operator is seated directly over this single wheel at the front. Behind the wheel is the cutting blade and as the cotton is cut it goes through here." Taking off the covering plate at the side, he showed me the ingenious mechanism of rotating spindles which separates the cotton boll and discharges it through a suction hose into the high-sided mesh cage behind.

Up and down the connecting roads strings of these cages on

trailers were being towed to the storage depot, wisps of cotton lifting from their loads and blowing over the ditches.

Before he headed his harvesting machine into the cotton bushes I asked the operator, Atageldy Gishikov, what appealed to him most about his job.

Without hesitation, he replied, "My mother and father picked cotton by hand. It was hard, hard work. With this machine it is easy."

With that, he wheeled his machine into the cotton bushes—"for a kilometre and more," Orazov explained—and the other machines followed in spaced lines. When I looked back they were deep in the field like mechanical monsters among the vegetation.

Hand-picking must still be done, however. In some fields I noticed bright splashes of color among the bushes. Women in their long gowns were picking the cotton by hand and the filled sacks stood by the roadside waiting to be picked up.

"Most of our work is mechanized—the seeding, which starts around the beginning of March, the irrigating, which has to be done five or six times during the season, and most of the harvesting. We even have our own crop-dusting plane," Orazov pointed out.

"But this is the first week of October. Somewhere around the third week the winter rains will begin. We have to get the crop in before they come. We start in September, but most of the harvesting is done this month. That's why we are using every machine and every available picker."

I asked him how many workers were employed on the farm and what they were paid. With close to 1,000 workers, he said, the rates of pay, including bonuses, were 450 roubles a month for tractor drivers and 400 roubles for other categories of workers.

"What do the hand pickers get?" I asked.

"They get 20 kopeks a kilogram. A good picker can earn 20 roubles a day by picking 100 kilograms."

I voiced my surprise. "That's a lot of cotton to pick in a day."

"It's no exaggeration. We have a lot of experienced pickers who do it."

Others in the car chorused their agreement.

From a distance the storage depot looked like so many dirty white houses in a large enclosure dusted by a light snowfall. But the houses were stacks of cotton and the ground was white in places from the spilled fluff. Some of the stacks under their high sloping roofs were complete. Others were still being built. The trailers delivered their loads of cotton at the foot of the stacks, the conveyors ranged against the sides carried it to the top and workers knee-deep in cotton moulded it into shape. All around there was a sense of urgency. The trailers were towed out again as soon as they had discharged their loads and the conveyors never stopped.

I looked at the workers raking the cotton into place at the top of the stacks.

"That must be the hottest place of all to be working on a day like this," I remarked.

"Here, we are used to working in the heat," said Orazov. "Still, our scientists tell us that working in high temperatures, 37 degrees and higher, is less productive than working at equivalent temperatures below zero."

Seyitniyas mopped his brow. It was hot, even in the shade, and out in the fields the sun was searing. "It always gets hot like this before the rains begin," he said. "In Ashkhabad this morning it was 38 degrees."

The coolest place was the thatched shelter where we ate lunch, served on a carpeted table and again a variety of Turkmenian soups, salads and meat dishes. Soon the conversation turned to the availability of water, a topic never far from the minds of farmers in Turkmenia. To Orazov, telling us about plans for the expansion of agriculture, the availability of water was the question to be solved.

"This farm has been established for 13 years," he declared. "Last year our quota was 11,700 tons and we produced 13,600 tons. This year our aim is to produce 15,000 tons. Now we sell our raw cotton. Next we intend to build our own mills. Now there are four state farms in the Ashkhabad area. Eventually there will be 14. Give us the water—and I am sure we will get it—and our future is assured."

The contrast between the dry areas of the past and the watered areas of the present is apparent in every kilometre of the road that runs east and west of Ashkhabad at the base of the Kopet-Dag foothills. Sometimes it is bordered by huge irrigated fields, fringed by trees, and sometimes it is open to areas covered only with desert growth.

Beyond the foothills, which are in Turkmenia, rise the mountains of the Elburz Range in Iran. Where water runs from the foothills, in streams that become bare and dry after the rains end or underground in springs, the villages are built close to the buried sites of earlier peoples who settled close to the same sources of water and entered into the Turkmenians' ancestral origin.

One such village is Nissa, the village of the legend of Ashkhabad. On the hills above it archeologists are excavating the ruins of a fortress built by the Parthians, who lived in this land 2,300 years ago and won a reputation for their prowess as horsemen and archers which has survived in the English language to this day in the term "Parthian shot". It derives from their battle tactic of galloping around an enemy force firing arrows into its midst, but avoiding close combat. Under attack they retreated, firing their arrows from horseback as they fled.

The fortress, still half-buried in the sand, must once have been an imposing structure. That is evident from the size of the rooms, outlined by the excavated base of their walls, the brick ovens and the connecting passages. The Parthians chose their site well, on a hilltop commanding a sweeping view in every direction and apart from any other dominating height. But wherever they drew their water, from wells or springs, the hilltop now is dry, tufted with desert plants and a thin stubble of yellow grass.

Presumably they grew their crops on the flats below, still under cultivation all these centuries later, but on a scale they could never attempt. From where I stood on the height, they were an expanse of green, the green of crops and pastures, and the brown of harvested soil, dotted with clumps of trees. And from them, muted by distance, came the sound of machines at work.

On our way back to the city from Nissa, Seyitniyas clutched

my arm and pointed to the massive rampart of the Elburz Range looming out of the purple haze above the foothills.

"You see that mountain," he said. "That is where the Americans had their installations, spying on us. How would Canadians feel if they knew that everything they did was being watched from across their border? Continents and oceans lie between our country and the United States. In one place only, in the Bering Strait, do we share a border. We do not threaten their border. Why should they threaten ours?"

"Where are the installations now?" I asked.

"They dismantled them and took them to Turkey, instead of Afghanistan, as they had hoped."

Undeterred, the U. S. plans to increase the capacity of its Radio Liberty to broadcast propaganda to the republics of Soviet Central Asia proclaiming the superiority of the American system. Only the politically naive will believe the U. S. government's claim that the intent is to disseminate information, not to incite unrest. And only the politically obsessed in Washington can believe that the broadcasts will be heard by receptive ears in Turkmenia or any of the Central Asian republics.

The Turkmenian people are firmly convinced of the superiority of their socialist system which has given them full and equal rights as a nation and enabled them to rise from feudal backwardness to the forefront of progress. It is more than half a century since they defeated British intervention and thwarted the attempt to maintain them in colonial bondage. Why should they accept a U. S. invitation to return to the past?

In lifting their country out of the past, the Turkmenian people have retained, not only the open-hearted hospitality characteristic of Soviet peoples everywhere, but a particular courtesy and graciousness. I was conscious of it wherever I went, in talking to the women in the carpet plant while they demonstrated for me how the patterns were arranged, in my conversations with the operators of the cotton-harvesting machines, at supper meetings with officials of the State Committee for Publishing. Seyitniyas, as my constant companion throughout my stay, was its embodiment.

"You have accompanied us everywhere," I said to him as our visit neared its end. "When do you get your writing done?"

"I go around and talk to people during the day. Ideas occur to me," he replied. "I do my writing at night. You are a guest here for a few days. Why should I not give you my time?"

His courtesy extended well beyond his acting as organizer, guide and counsellor.

I contemplated the additional books I had accumulated in Ashkhabad, the china teapot and tea dishes which had been left quietly on my bed as a gift during my absence, and wondered how I would get them into my suitcase. Lyalya had bought another suitcase for all the packages she had gathered along the way. Now it was so full it would barely fasten.

We took off before dawn brought the torrid heat of another day and for a long time, it seemed, I could smell the fragrance of the roses in the airport gardens.

CHAPTER XIV

Man's Destiny Is Space

I returned from Siberia with the thought that if I were a Soviet citizen, this is where I would choose to live. The frontier that languished so long under the tsars, a land of exile and neglect, is being transformed under the Soviets into a frontier of a new and vibrant kind such as the world has not seen before.

Though the histories of the two countries have differed, popular Russian and Canadian concepts of the north remained the same until this century. In both it was seen as a bleak, inhospitable and remote territory, its small settlements few and isolated. The strictures placed by this isolation on the lives of those who worked there, the fur-traders, trappers and miners, the storekeepers, government officials and police, made it a place of virtual exile, whether decreed by the tsars or dictated by the needs of companies and governments. It was home only to the natives whose people had lived there for centuries. And in both countries the impressions of the north conveyed by those who had lived there merely confirmed the prevailing concept.

What sets Siberia apart today is not only what is being done, but how it is being done. Of all the lands discovered and colonized by European powers during the conflicts and conquests that accompanied the rise of the capitalist system, Siberia was the one vast territory that remained backward and relatively undeveloped at the outbreak of the First World War, despite the more than three centuries of Russian exploration and occupation which at its farthest had reached to California. The Soviets inherited the backwardness and suffered in their early years from the lack of development. Now, its resources almost untouched and beyond the grasp of the multinationals that

have seized on the mineral wealth of Canada and Australia, it has become the first such land to be developed under a socialist planned economy.

I asked myself as I travelled through Siberia, not so much what is similar but what is different. The similarities of landscape are inescapable, springing to memory with every glimpse of a river that recalls the Mackenzie District, a valley suggestive of the Yukon. But in Yellowknife I can see apartment buildings, office buildings, hotels, as impressive as those in Yakutsk, roughly on the same latitude as Yellowknife. The open-cast diamond-mining operations at Mirny are equalled in scale by the open-cast lead-zinc mining operations at Pine Point on Great Slave Lake.

What is different is the socialist basis of development. The hydro-electric power grid supplied by the new dams on the Angara River, the oil and gas pipelines, the BAM Railway, the new towns like Surgut and Ust-Ilimsk, are all part of an unfolding plan. They represent an enormous investment of billions of roubles. But the wealth produced by the industrial complexes, the oil and gas network in the Tyumen Region, the wood-processing plants at Bratsk and Ust-Ilimsk already in operation, the diamond-mining operations at Mirny, the coal-and-steel complex taking shape at Neryungri, will repay the investment and continue to be reinvested in still newer towns and industrial complexes that as yet are only on the drawing boards. These new towns and complexes still to be built are not undefined prospects for an indefinite future, dependent on some multinational's cold calculation of when they can most profitably be developed, but part of a comprehensive plan of socialist development being brought into being phase by phase. Tommot Sivtsev could speak with confidence in telling me that the railway will also reach Yakutsk.

But Canada has its new towns too. One is arising at Tumbler Ridge in northeast British Columbia, site of the huge Sukunka coal deposits, a project which gave me a particular interest in Soviet plans for development of the Neryungri coalfields and Aldan iron deposits.

To expedite development of the Neryungri coalfields, as I had ascertained, the Soviet Union has signed a contract for

delivery of coking concentrates to Japan in return for machinery and equipment. On completion of the development, there will be a new town built to serve a new steel industry. Whether or not coal and coking concentrates are shipped to foreign markets, its purpose is to supply the Soviet Union's own expanding needs. The socialist economy will have a new enterprise and the benefits will be reflected in higher living standards.

No such prospects, unfortunately, are offered by the new Canadian coalfield. It will be developed by two giant corporations, Dennison Mines and Teck Corporation, which will also build the new town for between 5,000 and 10,000 people. Its sole purpose will be to supply Japan with metallurgical and thermal coal. To enable the companies to ship the coal, the British Columbia Railway, owned by the provincial government, must spend close to half a billion dollars building 129 kilometres of railway to link up with the main line of the Canadian National Railways, owned by the federal government, which in turn must spend a similar amount on rolling stock and upgrading its line. And the federal government is committed to spend a further \$100 million on the construction of a coal port outside Prince Rupert. Merely to recover this investment by government, it is estimated, will take 22 years. British Columbia, which for half a century has been seeking to establish a steel industry, will be no closer to this objective when the coalfields are developed but instead the poorer for depletion of the resources upon which a steel industry must be built.

In Yakutia, as in all Soviet republics and autonomous national areas, the national rights of the Yakut and other native peoples are fully recognized in law and in fact. When I tried to explain to a group of Yakuts the basis of the land claims made by Canada's Native Indian and Inuit peoples, the demands for recognition voiced by the Métis, they shook their heads in disbelief.

How do you explain to people who have never known discrimination, who have an equal opportunity to enter any occupation they choose and full voice in all decisions affecting the development of their homeland, a situation such as that at Pine Point? There the Canadian government spent close to \$90 million building the Great Slave Lake Railway to serve the min-

ing operations of another giant mining corporation, Consolidated Mining and Smelting. Few Native Indian people are employed in the operations, however.

As Thomas R. Berger, the British Columbia Supreme Court judge appointed to inquire into the social and economic impact of gas pipeline construction in the Mackenzie valley, observed in his report : "Once the complement of white workers was installed in the town, not only was there no incentive to employ native people, there was a disincentive. The presence of native employees would have altered the character of the town."

If Yakuts find this hard to believe, they are appalled by even uglier aspects of discrimination which dim their respect for Canadian technological accomplishments in the north.

When Inuvik was built in the Mackenzie delta it was intended to replace the old settlement of Aklavik, which had many disadvantages as a site. Inuvik was to be a model northern town. Yet, as Dr Hobart testified before the Berger inquiry in 1975, "discrimination was built into the piling foundations of this community. You could see it from the air, before ever setting foot in town, in terms of where the utilidor did run, the white serviced end of town—and where it did not—the native unserviced end of town."

What makes Siberia a frontier of a new and different kind is precisely the multi-faceted aspects of its socialist society—the equality and unity of its peoples, the scientific and educational institutes, cultural and recreational centres, which provide the opportunities and facilities available in the European republics, complemented by television and radio and by the simultaneous publication in major Siberian cities of national newspapers transmitted by satellite. Siberia has ceased to be a frontier in the old accepted sense. Scientists, architects, writers, artists, sculptors, all have full opportunity to pursue their careers and their scope is often the greater because this is a new country, posing new challenges, exploring new methods of development.

New cities in the north allow architects and planners to experiment with new designs, new building methods, new planning concepts. One illustration of this was the contest spon-

sored by *Tekhnika Molodyozhi*, a popular magazine of science and technology, in conjunction with the Soviet Artists' Union. Under the heading "Siberia Tomorrow", artists, whether professional or amateur, and readers generally were invited to submit paintings and drawings depicting their ideas of what Siberia would be like in the future.

The most popular concept among the hundreds of entries submitted was that of domed cities with their own artificial climates. But the imagination of the artists, sometimes supported by scientific and technical explanation, also ran to ringed towers and platforms on a single support powered by solar heat, to elevated trains on monorails strung across the taiga, bubble automobiles on powered highways, both surface and underground, dirigibles carrying cargoes from spacedrome to spacedrome, finned boats and dragonfly-like airships.

The common theme of all the submissions was preservation of the environment, use of non-polluting sources of power and efficient pollution controls, and harmony of the landscape created by people with that fashioned by nature.

For Soviet citizens everywhere, Siberia has become one of its two great frontiers—a frontier alive with new ideas.

The other great frontier is space. It was logical that the Komsomol volunteers working on the BAM Railway should name their first settlement Zvezdny, after the Gagarin Cosmonaut Training Centre outside Moscow, for it was symbolic of the fusing of the two frontiers. Space exploration has caught the imagination of Soviet young people. They know the names of their cosmonauts and the missions they have flown. And they are avid readers of the science-fiction which in recent years has become so popular in the Soviet Union.

Soviet science-fiction, however, differs in one fundamental respect from the science-fiction published in the West. The characters in its stories roam the cosmos, discover strange new worlds, encounter bizarre new life-forms and survive unknown perils, as they do in Western science-fiction. Soviet science-fiction writers draw on what is often an expert knowledge of the various sciences to give their stories plausibility, just as the best of Western science-fiction writers do.

But where Western science-fiction writers, with rare excep-

tions, see change in everything, but never in the capitalist system of society, projecting its expansion into space and the indefinite future, Soviet science-fiction writers try to project the society of the future and imagine the new forms it will take. Interstellar wars, conflicts with the hostile inhabitants of other worlds or between earth colonies for control of some rare resource, are not part of mankind's future as they envisage it. For them, any extraterrestrial civilization capable of travelling to other solar systems must also have evolved a system of society to which war is unnecessary and abhorrent—or have been destroyed through its inability to reconcile its social organization with the weapons of destruction created by its science.

The Soviet approach to its space program is in harmony with the visionary projections of its science-fiction writers: how can it serve human needs, how can it advance human progress, and how can it become an instrument of international cooperation rather than an extension of international conflict?

One morning while I was in Moscow I went to the Gagarin Cosmonaut Training Centre, popularly known as Zvezdny, some 30 kilometres to the northeast of the city.

Set amid woods, it is in fact a small town in its own right and a very pleasant one, centred around the administration buildings, the hydro-training building and the centrifuge, slightly smaller than the one in Houston, Texas, but considered to be more advanced because it was built later. Less than two decades ago Zvezdny had a population of 350. Today the population is 4,000 and growing as the space program expands.

At the centre of the complex is Gagarin Square, dominated by a statue of Yuri Gagarin which probably has aroused more controversy than any aspect of the space program itself. The statue portrays Gagarin in a stern mien and that is what irks the critics, who maintain that it should have shown him smiling as he was in life.

Most towns have their traditions, some so old that their origins are obscure. Zvezdny has a splendid new tradition. After each spaceflight the returned cosmonauts are welcomed back officially at the base of Gagarin's statue, after which they plant a birch tree in the square. At the time of my visit 47 young

birch trees had been planted and even though the need for more planting space eventually may compel changes as the number of manned spaceflights increases, I hope the tradition continues, symbolizing as it does the part cosmonauts are playing in protecting the environment.

Zvezdny also has a museum. As they told me there, "When we began collecting the material from the early flights, the gifts from all parts of the country commemorating Gagarin's first flight on April 12, 1961, and his personal documents recovered after his fatal plane crash on March 27, 1968 we realized that we were illustrating one of the greatest advances in mankind's history even while that history is being made. That is how the museum started."

Major-General Pyotr Klimuk, the centre's deputy chief, was waiting for me on the sidewalk outside the main administration building, an impressive figure whose breadth of shoulder, almost as if he had been hewn out of a block, would single him out anywhere. He shook my hand warmly, welcoming me to Zvezdny.

"When you lift off from Baikonur, our cosmodrome in Kazakhstan," he said, "it's the culmination of long training. This is where we prepare for the flights."

Sitting at the polished table in his office, listening to this cosmonaut who has received twice the coveted Hero of the Soviet Union award for his three spaceflights, I was conscious of his vitality, his face alight, hazel eyes shining as he spoke.

When I asked him what the Soviet Union expected to achieve through its space program in the years ahead, his answer was quick and incisive.

"First," he explained, "we have to perfect our present system of orbiting men and women in space for prolonged periods and overcome the complex physical problems. At the same time, we are constantly enlarging our experience and developing new technology.

"Eventually we shall reach the point where we can build orbiting platforms in space in which people can live and work. These platforms then will become the launching sites for spacecraft to explore the other planets of our system because they will already be in zero gravity. We have learned a lot about



The monument to Yuri Gagarin, the first cosmonaut, in Zvezdny, where the cosmonauts live and work



Cosmonaut Alexei Gubarev telling Harold Griffin about the Salyut orbital space station during the author's visit to Zvezdny



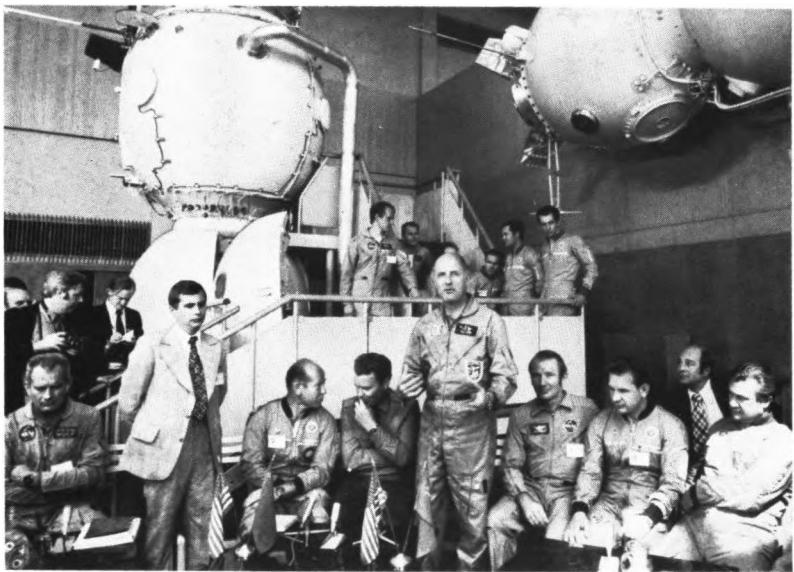
Cosmonauts Vladimir Lyakhov (right) and Valery Ryumin returned to earth after 175 days in space



The Soyuz-28 international space crew consisting of Alexei Gubarev (left) and Vladimir Remek (Czechoslovakia) before blastoff



During the working meeting with journalists: Pyotr Klimuk, deputy chief of the cosmonaut training centre (left)



Soviet cosmonauts and American astronauts, who trained under the Soyuz-Apollo program, talk with Soviet and foreign journalists in Zvezdny

Mars and Venus with our automatic space probes and by the time we are ready to send a manned mission to other planets we shall know a lot more.

"At the moment, overcoming the physical problems is the most important task. To build space platforms, people must be in space for prolonged periods. To launch a manned spacecraft on a mission to Mars, people must be able to live in space for two to three years. We have to know and be prepared for the problems they will face, physical and psychological, before any mission leaves."

I learned more about the problems of weightlessness or zero gravity—the Americans prefer the term micro-gravity on the grounds that no part of the cosmos is completely devoid of gravity—when I was conducted around the vast hangar housing the spacecraft used in training cosmonauts by Col Alexei Gubarev, himself a veteran of two spaceflights—one of them was the first international mission with Vladimir Remek of Czechoslovakia—who is in charge of training international space teams.

A tall, spare, humorous man, he told me about the physical effects of weightlessness experienced by the first cosmonauts.

"When Yuri Gagarin made the first flight in 1961," he said, "he only orbited the Earth once and he returned in good physical condition. But when German Titov made the second flight he orbited the Earth 17 times, and he returned in poor physical condition.

"After that we intensified both our training for weightlessness and our studies of its effects. We found that the first ten days in space are the most critical. During that time the cosmonauts have no appetite, their body temperatures are either too high or too low, and they experience a certain disorientation.

"In space there is no gravity to draw blood from the head, so cosmonauts suffer severe headaches. To train myself for space, I slept for several months at a sharp angle with my head down. And," he added drily, "my wife didn't appreciate it at all."

In Ashkhabad later I recalled his remark with a better appreciation of the discomfort to which he had subjected him-

self. One of the supports of my hotel bed gave way during the night, leaving me asleep head down, and I woke in the morning with a splitting headache. It diminished any ambition I had to go into space.

Recounting his own sensations in space, Gubarev pointed out that those who spend two months or longer in space return in better physical shape than those who make shorter flights because they have had more time to adjust to conditions of weightlessness.

"In space you float and everything drifts away from you. At the end of a year in space you could return without a feeling of having hands and feet, like a fish," he said. "After a month in space on Salut-4, I had to be lifted out of the spacecraft and placed on a stretcher because I could hardly move my limbs.

"The other side of the problem of adapting to weightlessness is readjusting to Earth's gravity. Readjusting to Earth is more difficult because you are physically weaker. Like a sailor returning from a long voyage, you have to get used to walking on firm land again. You find yourself wanting to dive all the time. In fact, we are warned by our doctors to stay away from balconies until we have readjusted for fear we might feel impelled to dive off.

"You can imagine the problem of weightlessness for people on a mission to Mars, for example. We can imagine what it may be, but we have to know."

In the first years of the space program cosmonauts were trained in planes, a method of training that had its severe limitations because the condition of weightlessness could be attained only briefly, about 30 seconds. Now they are trained in water, which is approximately 80 percent as effective as training in space itself would be.

The hydro-training building at Zvezdny is a huge structure, with a pool 23 metres in diameter and an adjustable water depth of up to 12 metres. Here I watched the instructors training cosmonauts under water, guiding them as they glided like scuba divers through skeletal spacecraft submerged in the pool, simulating the movements they would have to make in performing tasks within the spacecraft during a flight.

"We have learned a lot about the problems of weightlessness now," remarked Gubarev. "With this special training program we can alleviate the effects of the initial period in space."

In a condition of weightlessness, the body is no longer under the pull of gravity as it is on Earth. Muscles tend to atrophy and since the heart has to pump less blood, so does the heart muscle. Generation of red-blood cells is slower. The body retains less liquid.

To offset these effects, cosmonauts in flight are required to devote at least two hours each day exercising with the training equipment aboard the spacecraft. They have to wear special load-simulating suits called "penguins" and spend time in a vacuum cell designed to place negative pressure on the lower part of the body. They eat a specially prepared diet containing essential amounts of salt and liquids.

Not all the problems have been solved yet. In a condition of weightlessness, the body loses salts of potassium and calcium. For Vladimir Lyakhov and Valery Ryumin in their record 175-day mission aboard the Salut-6 space station, the loss was eight percent, but medical scientists believe the loss would be dangerous only if it surpassed 20 percent.

Other unsolved problems are changes in the body's immunological system and the danger that certain microbes which normally are harmless in the body may become pathogenic during a spaceflight. From an orbiting space station, a stricken cosmonaut can be returned to Earth, although such an emergency has never arisen. On a manned space mission to Mars, perhaps months outwards bound from Earth, return would be impossible and provision against every foreseeable contingency would have to be made before the mission left Earth.

The Lyakhov-Ryumin space mission resolved one unanswered question for medical scientists: the effect of changes in red-blood cells. All the red-blood cells of the two cosmonauts were generated in space under conditions of weightlessness and the cells differed somewhat from cells generated normally on Earth, although their principal function of carrying oxygen was not impaired. When Lyakhov and Ryumin returned to Earth, however, the cells generated in space were replaced by normal Earth-type cells, and without any discernible harmful effect.

The psychological problems are no less complex. As spaceflights are lengthened, the need to select cosmonauts able to get along with each other in the confined quarters of a space station becomes greater.

Soviet psychologists, after two decades of studying the problems, are not yet satisfied that they have found the best method of selecting crews, but they have devised various tests for determining compatibility.

In space, cooperation in performing tasks is important and, if an emergency should arise, essential to survival. Tests conducted by Mikhail Novikov to ascertain the ability of cosmonauts in training to assist each other in completing a task have revealed, for instance, that when two people start helping each other their pulse rates also begin to synchronize. The closer they coincide and the higher the pulse rate, the greater the likelihood that the two people will be compatible in space.

Tests, confirmed by experience in space, also have proven that compatibility does not necessarily depend on like being teamed with like. The qualities of individuals and how they interact upon each other are complex. Provided there is mutual respect and understanding, individuals of opposite qualities can be quite compatible.

Space does create its own psychological condition, however, just as the ocean did centuries ago for the first intrepid voyagers leaving the known behind them to venture into the unknown. For Lyakhov and Ryumin this condition was eased, for two-way television communication enabled them to see and talk to relatives and friends and to watch special programs, maintaining their closeness with Earth.

Academician Oleg Gazenko, director of the Institute of Medical and Biological Problems and an internationally recognized Soviet specialist in space medicine, foresees spaceflights continuing to increase in duration so long as medical scientists are convinced there are no injurious effects.

"Today spaceflights are performed only by specially trained people," he says. "In ten or fifteen years any person in good health will be able to go into space. The development of reusable space systems will make it possible to send experts into space to conduct complicated scientific experiments. Having

completed the mission, the scientists or engineers will return to Earth and their jobs. There won't be any need to become a professional cosmonaut."

Much the same view is held by the U. S. National Aeronautics and Space Administration, which is planning to send "payload specialists" with its first Spacelab mission in June 1983. The "payload specialists", having satisfied health requirements, will not have to undergo any rigorous training. Their preparation for going on what may be only a single mission into space will be limited to two months of learning how to live and work in conditions of weightlessness at Johnson Space Centre in Houston, Texas. Their actual role will be that of specialists employed to conduct experiments in space for their corporations, which will rent space on the mission from NASA.

Until space travel reaches the stage where specialists can be sent up to orbiting stations, however, cosmonauts themselves must perform the various scientific experiments, many of which already have produced practical benefits.

In taking me through the Salyut space station at the training centre, Gubarev showed me the oven used to make the first perfect welds, a feat unattainable on Earth. Since those early experiments, hundreds of others have been carried out, more than 180 of them during the years Salyut-6 has been in orbit. Materials which will separate in melted form on Earth can be mixed to produce new alloys in space and scores of such experimental materials have been created.

What has been learned from those smelting and welding experiments is a small part of the immense fund of information, which already fills 200,000 volumes, obtained from the Soviet Union's six orbital stations and 40 manned space missions flown up to April 1981, supplemented by the far larger number of automatic space vehicles—around 1,300 in the Cosmos series alone—ranging from meteorological and communications satellites to interplanetary probes.

The practical benefits include production in space of a completely homogeneous tricomponent transistor crystal, KRT, an alloy of cadmium, mercury and tellurium, which cannot be created on Earth because the melt separates rapidly into layers. The virtue of the new crystals is that they can be used

in building receivers of infra-red radiation with a wide-range spectrum ranging from one to 35 millimicrons as compared to the one to eight millimicrons range of present receivers.

On the Salyut-6 space station some 200 experiments have been conducted in spraying gold, silver and various alloys on metal and glass, experiments to which Academician Vsevolod Avduyevsky attaches considerable importance as a means of restoring the optical qualities of reflectors, particularly such instruments as telescopic mirrors used in outer space where they can be clouded by micrometeors and charged particles.

The potential benefits to medicine in making available drugs difficult or impossible to produce on Earth are apparent. One such drug is the anti-coagulant urokinase, now difficult to produce because it is hard to extract from the kidney the cells that make the enzyme. During the joint Soviet-American Soyuz-Apollo spaceflight in 1975, this was one of the experiments conducted. The urokinase enzyme was isolated in almost pure state, but it had to be frozen before it could be brought back to Earth and freezing destroyed it.

Urokinase can be made by a process called electrophoresis. In space, with its near-total absence of gravity, there are no convection currents. Dense materials do not sink nor do lighter materials rise. The various components of liquids can readily be separated and kept separate. By placing kidney cells in liquid suspension and running a low electric current through them, they can be separated according to their electrical properties and the enzyme-producing cells can be isolated for culturing.

The advantage of such drugs produced in space by electrophoresis is that they are free of all impurities, which no drug produced on Earth can be, and as pure drugs they have higher curative properties and create no side effects.

Soviet farmers, fishermen, engineers and geologists already know how cosmonauts, studying their problems from space, have given an extra dimension to their work.

"When I was in space," Gubarev recounted, "I always knew when I was over Soviet territory by the size of the farmlands. There were rivers, roads and railways cutting through them, but there were no boundaries, just broad expanses, dotted by

wooded areas, with the occasional cluster of buildings where there was a town or settlement. It was so different from the smallholdings of Western Europe, like a patchwork quilt with boundaries running every which way."

From space animal herders can be directed to the best pasture areas. Fishing fleets can be guided to the areas where they can expect the highest yields. Oil drillers can be advised of the most promising areas in which to look for oil.

"Oil was found in Daghestan as a result of studies made from space and the saving in exploration costs was estimated to have been \$60 million," Gubarev reported.

Space studies, both from manned missions and automatic satellites, are also saving costs in building irrigation systems in the Central Asian republics and the southern areas of the Russian Federation. From the information gathered on snow and ice patterns, the amount of water available and earth structure, engineers can estimate their costs and plan their projects more accurately.

Soviet viewers have become accustomed to television programs transmitted by satellite, just as Canadians have. Less apparent, but vitally important to the world's future, is the watch being maintained by Soviet satellites, photographing the land and sea below and monitoring pollution in the atmosphere.

By studying from space the spectrum of the Earth's halo, in which the intensity of the colors is governed by the particles and aerosols present in the atmosphere, both natural and man-produced, pollution can be measured and the extent of its threat to life ascertained. The information sent back by the interplanetary probes which made a chemical analysis of the atmosphere of Venus in the course of their descent has given an extraterrestrial dimension to studies of the Earth's own atmosphere. These studies touch the interests of all nations. Just as deterioration of the atmosphere on which all life is dependent is arousing common concern, so international measures to control and prevent pollution become a common cause.

While satellites and manned space missions study the vegetation on Earth, the effect of drought and flooding, the migration patterns of wildlife, they also are conducting a series of biological experiments as part of their study of weightlessness

and in preparation for the time when a manned space mission leaves on its first voyage into the solar system.

"When people go into deep space, they will need plants for food and air," Gubarev observed.

"On my flight, we took peas along. We felt that they were akin to ourselves, alive and suffering. In one experiment we turned out the lights and drew the blinds. The peas wilted. When we turned on the lights again and lifted the blinds, we felt that the peas recognized us."

Konstantin Tsiolkovsky, the schoolteacher and self-taught scientist whose theories pointing the way for space travel gained recognition only after the revolution, believed that water and air would be regenerated aboard future spacecraft, whose crews would produce much of their own food.

In earlier experiments the plants died before completing their life-cycle. But onions, garlic, dill and parsley have been grown aboard more recent missions and continuing experiments, including what is known as a biogravistat device to determine the effect of artificial gravity on plants, are bringing the answer closer.

A biological satellite launched in September 1979 is carrying the seeds of plants such as maize, flax and cabbage in a terrarium to allow scientists to assess the effect of zero gravity on their growth. Under the gravity of Earth, no matter how the seeds are planted, the roots grow down and the plant grows up. In conditions of weightlessness, the roots may grow down, they may spread out or they may grow up.

Fruit flies, the favorites of biologists, already have been reared in space aboard satellites. Their development has been monitored from egg-laying through the larval stage to birth of the new generation. On the biological satellite launched in 1979 a fruit fly was placed in a special centrifuge in which it can rest at any point from the centre, giving it the equivalent of gravity.

The experiment with eggs of the Japanese quail aboard the same satellite is designed to ascertain if this small species can become part of a life support system in space—the eggs it lays daily during its oviparous period are larger than hen's eggs in comparison with body weight. The eggs have been placed in a

space incubator where the embryos will pass through all the initial stages of development in orbit.

Now that the U. S. space shuttle Columbia has made its first successful flights, similar experiments will be conducted aboard the Skylab. But here the contrast between the U. S. space program, with its occasional spectacular achievements, and the Soviet space program, less spectacular perhaps but far more solid in its achievements, is greatest.

"Our spaceflights focus all the scientific knowledge and are supported by all the industrial capacity of our socialist state," Klimuk said. "In all the technological problems we set ourselves to solve and all the experiments we undertake, all our scientific institutes and all our industries are consulted and asked for their proposals. Ours is a full socialist involvement."

In its efforts to interest big corporations in renting space for experimental projects aboard Skylab, NASA is encountering scepticism about the value of developing new products in space as counterposed to similar products on Earth, reluctance to make long-term investments running into hundreds of millions of dollars with no prospect of any quick return on those investments, and a general attitude that most of the experimental work is really basic research which should be done by the government.

Corporations fear for the protection of trade secrets and patent rights, particularly since the U.S. National Aeronautics and Space Act, which established NASA in 1958, reserves as the exclusive property of the government any invention made in the course of work done under contract to NASA. The same act stipulates, however, that NASA may waive the government's rights if it is deemed to be in the national interest. NASA has sought to alleviate corporate fears by adopting the position that the act does not apply to corporations renting space aboard Skylab, but the complications of patent provisions in the act presage future legal battles in the courts over proprietary and patent rights.

The problem of proprietary and patent rights was well summarized by an American writer, Henry S. F. Cooper, Jr., in the *New Yorker* magazine in February, 1981:

"Even if the patent provisions of the act were rewritten, or otherwise circumvented, industry fears that difficulties would

remain. What if a discovery is made on a flight leased by a corporation, but the corporation uses equipment that belongs to NASA—a furnace, say, for making a new alloy? NASA, eager to soothe the business community, currently expresses the belief that the patent should belong to the corporation, with NASA retaining some sort of overriding interest... Presumably, NASA says, the corporation would have exclusive rights to the discovery; NASA would regard itself solely as the lessor of the spacecraft, and therefore as being out of the picture. (The agency does, however, demand assurances that a beneficial new product discovered or developed aboard the shuttle will be produced in quantities sufficient to meet the need.)

"These solutions seem logical, but they have never been tested in court, and it is impossible to say that they are binding until they have been; regardless of who owns the furnace, it is useful only because it is inside a spacecraft paid for and operated in large part by public funds, and the sight of fleets of government-developed, government-owned orbiters taking off weekly for the enrichment of America's largest corporations might not be welcomed in all quarters. Industry itself might complain; if one company makes a discovery that puts it in the preeminent position in its field, could the other companies in that field, claiming that the rival was profiting from a public asset, bring an action against it?

"Clearly, the projected expansion of the capitalist system through the galaxy will be accompanied by growing pains."

The socialist system has no such problems—quite the opposite. In 1967 nine socialist countries formed Intercosmos, the Council for International Cooperation in the Field of Space Research and Space Exploration, coordinated through the Soviet Academy of Sciences—Bulgaria, Czechoslovakia, Cuba, the German Democratic Republic, Hungary, Mongolia, Poland, Romania and the Soviet Union, joined in 1979 by Vietnam. The joint program of research into space physics, biology, medicine, communications and meteorology undertaken by Intercosmos, drawing on all the scientific talent and industrial resources of the participating countries, has shown what cooperation can accomplish.

Since the first Intercosmos-1 satellite was launched in 1969,

flying the flags of the socialist countries, an international long-range communications system, Intersputnik, has been established in eight of the socialist countries. From joint satellite and space-rocket launches, Intercosmos now has progressed to joint manned missions by cosmonauts from the various socialist countries, trained at the Gagarin Cosmonaut Training Centre, the first of them the Soyuz-28 flight piloted by Alexei Gubarev, with Vladimir Remek of Czechoslovakia as researcher, which docked with Salyut-6 in 1978.

Intercosmos also has undertaken cooperative ventures with France and India. Two Indian satellites have been launched by Soviet rockets—Aryabhata, to study the sun, in 1975, and Bhaskara, to observe Himalayan snows, river levels, forests, farmlands and coastal waters, in 1979.

France, with which the Soviet Union signed an agreement in 1966, is engaged in joint space research with Intercosmos through its National Centre of Space Research, and one French satellite was placed in orbit by a Soviet rocket in 1972. French scientists have participated in experiments conducted aboard Salyut-6 and two French cosmonauts started their training at the Gagarin Cosmonaut Training Centre in 1980.

Valentina Nikolayeva-Tereshkova, who made her flight in 1963, remains the only woman cosmonaut, and when I asked Gubarev if other women were in training, he replied that several had been selected for future training but none was then at the training centre.

France, he added, had insisted that one of its cosmonauts be a woman. But when the list of candidates was reviewed by a joint French-Soviet panel set up to determine the selection, it could not find one woman who met the exact qualifying standards.

Soviet-American cooperation in space, which began in 1962 with an agreement on joint research between the Soviet Academy of Sciences and the U. S. National Aeronautics and Space Administration, and took more substantial form in the Soviet-U. S. agreement which led to the Soyuz-Apollo joint mission in 1975, holds the key to the future peaceful development of space.

By the agreement signed in 1972 the two countries undertook

to cooperate in space research and to use space for peaceful purposes. The first goal, to develop compatible means for the docking of Soviet and American spacecraft, was reached when Soyuz-19 and Apollo docked in space to form an integrated space system. Now, under a new agreement concluded in 1977, the two countries are committed to study the possibility of another joint mission by Salyut and the U.S. space shuttle.

The advantages of cooperation are clear. Communications and meteorological satellites, undreamed of at mid-century, are providing benefits to all nations. Satellites to beam solar power to earth are still a dream for the future. Yet who, having seen mankind progress from powered flight to spaceflight within this century, doubts that they will be the reality of the next?

The Columbia space shuttle is an achievement for American space technology. But no one marking the fact that a large part of its \$6.7 billion cost was financed by the Pentagon and that of the satellites to be placed in orbit during the next five years, 14 will be for the Pentagon, can take comfort from this threatened extension to space of military weapons. It is an affront to the peaceful aspirations of all peoples striving to rid the world of the threat of nuclear disaster in the only way that it can be done—through detente and agreement on progressive disarmament.

In discussing future space developments with Klimuk, I asked him about the possibility of creating an artificial gravity system.

"We're working on it," he replied, making motions with his hands to indicate rotating objects. And, as I learned later, a number of scientific papers on artificial gravity have been written.

Academician Gazeiko, in an interview published by *Soviet Life* in April 1980, pointed out that to colonize space, rotating systems must be created to simulate Earth conditions—artificial gravity and division of time into periods of day and night. He noted that proposals for creating artificial gravity were based on the theory that acceleration equal to the force of gravity in the peripheral parts of rotating systems would eliminate the negative effect of zero gravity. But any movement in such a system, he said, would cause the complementary acceleration which gives

cosmonauts an unpleasant feeling in the initial stages of space-flight.

Once a radius of rotation to eliminate these unpleasant effects can be found, he believes people will be able to live in space much as they do on Earth.

His confidence in mankind's future in space is reflected in his statement, "I believe that humankind can be as happy in space as on Earth."

Man's destiny is space. From the time he left his birthplace in Africa to migrate through the world, rearing his civilizations, pinnacle upon pinnacle, mastering the seas and the air, it was inevitable that he would attain the level of technology that would take him into space—the unlimited frontier of the future. The moon, the planets, the stars that have stirred his imagination for countless thousands of years, would be within his reach.

Years ago I wrote these lines:

*And now, like gods in splendor we arise
Upon the sputnik's flaming tail
To probe the deeps of space,
For we have come a million years to claim
This future for our race.*

Space travel has made poets out of the cosmonauts too, for they are among the few who have seen the dazzling splendor of the cosmos from space.

"We have seen how small and fragile Earth is in the immensity of space," Klimuk said to me as I left. "Its resources are limited and so is its capacity to support its population. It cannot continue indefinitely to absorb pollution. Earth is our home and we have the capacity to destroy it. We have the greater capacity and responsibility to work together to preserve it, to protect our environment and live together in peace. That has to be the future."

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Canadian writer, poet and historian, Harold Griffin has been an editor and journalist for half a century, leavened by work as a gold miner and fisherman during the depression years.

Starting as a cub reporter in his native London at the age of 15, he left Fleet Street three years later to emigrate to Canada, where he worked on daily newspapers and entered the labor movement as editor of labor weeklies. For many years he was editor of the *Pacific Tribune* and, more recently, *The Fisherman*, which speaks for the United Fisherman and Allied Workers Union, in which he now holds life membership, the union's highest honor.

He is the author of three works on Canadian history and contemporary affairs and three books of poetry, which have been translated into several languages.

In addition to his travels through Siberia and to Turkmenia in the fall of 1980 to gather material for this book, he has made three previous visits to the USSR as a guest of the Union of Soviet Writers.

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